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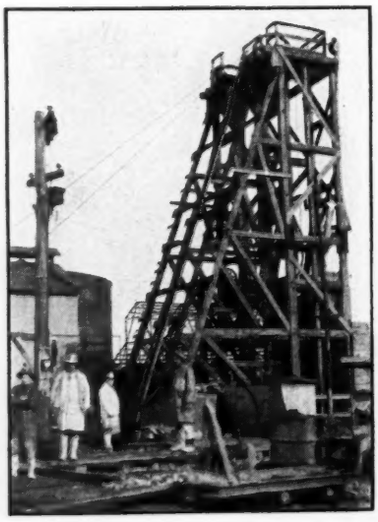

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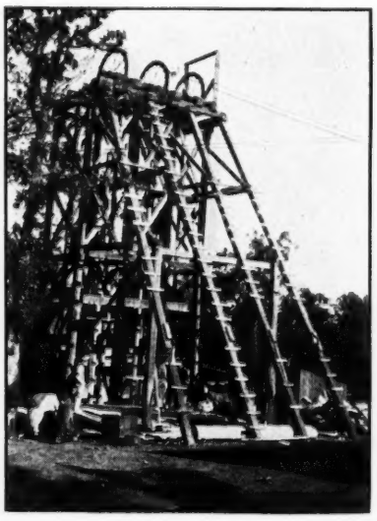

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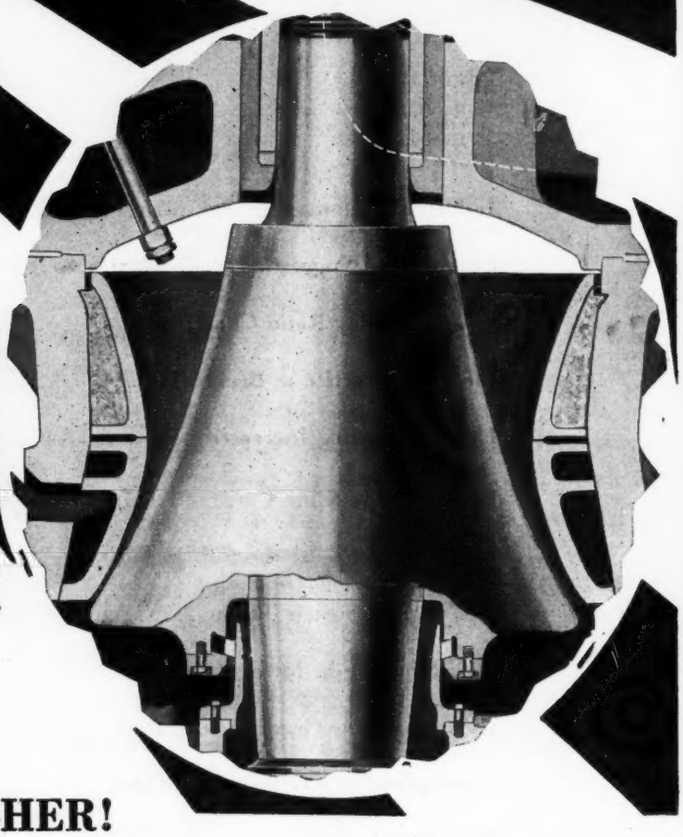

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Engineering and Mining Journal

June 22, 1931 A. W. ALLEN, *Editor* Vol. 131—No. 12

Safety First, Last, and All the Time

A DOLE, according to accepted definition, is a distribution, especially of gifts of charity. It is a word that precisely and accurately describes that new American institution, the bread line. An analysis of terms and a clarification of ideas is therefore pertinent in a study of a recent pronouncement by a representative engineering body, that warns "against all measures which, ostensibly providing insurance, would really bring about the dole." Equally provocative of analysis is the call "to preserve the essential laws and principles under which our people in the past have achieved unparalleled prosperity. . . ." Even a moron would have the wit to suggest that such laws and principles may also be responsible for unparalleled depression and unemployment; or that, at least, as guides to a course of national conduct, they failed to indicate the imminence of economic disequilibrium. Who is to decide what principles, so called, are sacrosanct and of eternal permanence? Many of our laws require modification, in the opinion of intelligent observers. For example: Planning without opportunity for cooperative action among the elements of an industry is merely a futile gesture, of no value to stem the evils of unrestrained price wars, overproduction, waste. Laws designed for trust busting, still in force, need examination in the light of present-day conditions.

Now that the anæsthetic effect of slogans invented to explain past affluence is beginning to wear off, a growing sentiment is arising for the application, in the economic life of the individual and of the nation, of the principles that underlie the safety-first campaign. Many years ago the collapse of a mine working was a comparatively common occurrence. The excavation methods that brought employment, profit, satisfaction were also responsible for the extermination of the working force. Planning was obviously lacking, or some phase of it was at fault. The problem was to insure against interruption and accident by reducing the possibility of incidence to either. Safety methods were introduced, to function in a manner complementary to production methods. The employer sponsored the innovation, and the employee was educated and urged, for the good of all, himself included, to contribute by cooperating to the limit of his ability and enthusiasm.

The need to plan for the safe and sane operation of the business machine is equally important, but economic stability cannot be permanently secured if the individual is not helped and encouraged to apply, in the conduct of his own private affairs, those recommendations for long-term planning and insurance against interruption of opportunity to work that industry is now being urged to adopt. Boasting and complacency are equally dangerous. To play with misapplied terms, to terrify or to hypnotize with slogans and catch words—this is unworthy of the scientist or the engineer. The immediate problem is to provide means whereby that inalienable heritage of every human being is restored—the right to work. Without that right, existence itself ceases to possess a meaning or a purpose.

Facilitating the Acquisition of Knowledge

AN INTERESTING PARALLEL may be drawn between current ideas on education and economics. In each instance the objective human being has been considered a standardized receptacle for information or goods. Highly efficient techniques of teaching and selling have been developed, but no technique of learning or purchasing. The opportunity for pioneer work in one of these fields, in a neglected phase of education, has been seized by that versatile student of current affairs, Prof. Walter B. Pitkin, of Columbia University, who has devoted much thought and research to the problem of developing an orderly and logical curriculum for the learner. A report of his findings and recommendations takes the form of a helpful and interesting book, "The Art of Learning," recently published by the Whittlesey House Division of the McGraw-Hill Book Company. At no stage in the development of civilization and knowledge was a treatise of this character more needed than at present, to help the average citizen to acquire the truth, the whole truth, and nothing but the truth. If a sufficient number of such citizens could be persuaded to follow the plan outlined in this volume, immediate relief from the hypnotic oppression of propaganda would result.

Professor Pitkin is not concerned at this time with the education of the child or the adolescent. The book under review, which must be taken seriously, as a working tool, is meant for those who wish to advance, by their own efforts, into broader fields of learning; for those who seek to overcome the disabilities consequent on an unfruitful educational period in school or college; for "Energetic, ambitious adults who, having been well trained to use their minds, find themselves with many leisure hours on their hands . . .; for "Equally energetic and ambitious adults who are the victims of the New Unemployment and must become proficient in some trade, craft, business, or profession, in order to make a decent living."

No treatise of this character can be expected to prove

a panacea for the mental and economic ills of every person who is interested in the title. The author is careful to explain that it is not intended for "sappy souls who sigh for inspiration, in the hope of being kicked upstairs. It is not addressed to worshippers of the Success Cult, who will read anything that promises quickly to increase their cash in hand." Nor is it designed for "pedants who fancy that true culture consists merely of knowing what certain ancestors did, wrote, and taught. It is a work book. In the hands of a lusty toiler, it will show solid profits."

A study of the volume has resulted in the conviction that Professor Pitkin has not overstated his claims. He has covered an immense amount of ground—in analysis, criticism, suggestion. Some of his comments will meet with violent opposition. The cynic and the skeptic—and, occasionally the technical specialist—will find opportunity for disagreement; but, fundamentally, he preaches a sound and healthy philosophy; and the great majority of those who read "The Art of Learning," and act on the recommendations made, will reap material and intellectual advantage.

Physical Aids to Metallurgic Efficiency

A MAKER of high-grade refractory brick was faced with only one serious problem. The quality of the raw and prepared material left nothing to be desired. Coarse and fine constituents of the charge were proportioned to give the correct volume of voids. The brick-making machine was the best that engineering ingenuity could devise. Tunnel kilns of modern design provided ideal conditions for firing. The one problem lay "in the neck of the bottle"—the bottle being the name given to the cylindrical bin used for the storage and delivery of the aggregate. Despite the fact that it was carefully filled with a perfectly blended mixture, the mass tended to bank and slide at intervals, with the result that some brick contained too little fine material, some too much.

An ore dresser happened along, examined the bin, recalled the trouble that occasionally resulted with the early type of cone classifier. A circular baffle plate, usually miscalled a "diaphragm," was recommended, to be placed just above the exit from the conical bottom of the bin. The change was made at negligible expense, and the problem was solved. All the material had to pass down through an annular opening. Banking and "piping" were prevented, and the even distribution of fine material in the aggregate was maintained until the brick was made.

A suggestion might have been proffered to the brickmaker that he eliminate the fine material, if the fact had been overlooked that channels or voids in the finished product constitute the principal cause for failure. The fine material is needed; and the same argument can be applied to bulk leaching practice, which operates in a manner entirely different from heap leaching. If the ore is submerged in the lixiviant, the flow of the solution must be staggered and deflected to maximum extent, by impingement against ore particles. If the physical composition of the charge is calculated as carefully as is the composition of a brick aggregate—and this can be achieved by degree and character of crushing—the formation of large channels, through which solutions will short-circuit, is avoided.

Too large a proportion of fine material, of course, may cause a high resistance to flow in some part of the charge, and a "break through" as pressure develops. But under controlled conditions the gravity leaching of fine material in contact with coarser material offers ideal opportunity for efficient dissolution and displacement of valuable constituents of an ore; and one may therefore wonder at the complacency discernible in some metallurgical statements reporting erratic extraction because short-circuiting occurred in some charges, owing to the uneven distribution of fine material. This unevenness is no "act of God"—irrevocable, irremediable. Certain methods of vat filling favor segregation, short-circuiting of solution, poor technical results. Adherence to a standard method of bin storage and delivery of aggregate has been shown to result in a lack of standardization of commercial brick.

The even distribution of fine material in a leaching charge is not impossible of achievement, and acceptance of erratic results in a mechanical detail of this character indicates the disadvantage under which any simple, nonpatentable method operates. No powerful commercial organization is interested in its success. Responsibility cannot be passed to a manufacturer. As a result, the claim is too often made that the problem is impossible of solution.

The kudos accruing from an innovation that permits the more efficient functioning of a simple and efficient process is negligible and undramatic when compared to the acclaim accorded to the inventor of some new and startling method, sometimes in spite of high cost of application. Simple fundamentals, to which organized common sense can be applied in the achievement of important technical and economic results, seem to fail to stimulate the research interest merited. The change in economic conditions now in evidence will have achieved much if it draws attention to neglected opportunities of this character.

Taxation of Net Profits Is Recommended

TOTAL ASSESSED VALUE of the mines, in one Western state, including property, plant, and net-proceeds valuation, diminished from $136,230,497 in 1930 to $53,776,417 in 1931. A less elastic method of mine taxation than one based on net profits would have proved burdensome. The logic of taxing by that method is evident at such a time as the present. One expects that taxation should be reduced during periods of industrial depression, and the net-proceeds method of assessment automatically reflects the status of the industry. In flush times the assessed value is higher, and taxes are increased. During such periods the state government shares in the general prosperity.

The injustice of valuing mining property for taxation purposes by a method based on an average over a considerable period is obvious to any student of current conditions. Prices of some metals have receded to new all-

time lows; and, obviously, if assessed values were to be based on long-time averages, many metal mines would have to draw on accumulated surpluses to pay taxes.

Mine valuations under the plan outlined are now based on metal prices and the operating surplus or net proceeds, so what the property earns is the basis of taxation. The tax is collected for a given year, and the valuation for that year should reflect economic conditions accurately. Public budgets are seriously affected in dull times, of course; but the authorities should take into account the ups and downs of prices and demand, and cut their budgets to fit the income from equitable taxation.

One Hundred Years of Electrical Engineering

ONE HUNDRED YEARS AGO, on August 29, 1831, a scientist, to whom the world owes much, wound two coils of wire on the opposite sides of a soft-iron ring, making connections to a battery and galvanometer, respectively. The deflections of the needle at the "make and break" of the circuit suggested further research, which in turn led to the inception and growth of the profession and industry of electrical engineering, with all the countless benefits that have accrued to the human race in consequence. An outline of the story of Michael Faraday is worth re-telling—his humble parentage and lack of education; an inquisitiveness about facts, engendered by apprenticeship to a bookbinder; the kindness of a patron of his employer in providing the means whereby he could attend a few popular science lectures; his subsequent appeal to Sir Humphry Davy, the lecturer, for laboratory employment, which led to a humble post at the Royal Institution at twenty-five shillings per week, and provided the appropriate surroundings for many years of patient research and ultimate discovery.

An educator, who should have known better, belittles, in a recent book on psychology, the achievements of the great inventors. "A myth has been created," we are told, "which prompts us to believe that, had we not been blessed with the genius of a few notable pathfinders, the human race would still be living in a jungle." A commentator, who finds inspiration and novelty in the contention, explains that the author in question "asks us not to imagine that, had Thomas Edison never lived, the world would be without electric light. That happy invention would have been delayed only a few months," is the superficial conclusion.

Without entering into a discussion as to who "invented" the electric light—Edison or Swan—no doubt exists as to the part played by that great pathfinder, Faraday, in laying the foundations of knowledge in the subject of electrical engineering. To belittle the work of the missionaries of progress, who really pioneered in scientific, medical, humanitarian advance, is to exhibit a lamentable ignorance of historical fact. A little more tribute to the great researchers, a little more generosity to their memories, might breed a sense of humility that is sorely needed in this much-advertised age. Holy Writ maintains that a living dog is better than a dead lion; but the metaphor loses force if applied to the evaluation of influence from inspirational and educational sources.

Metallurgical Extraction and Actual Recovery of Gold

CONSIDERABLE attention is being paid to the question of gold-ore treatment; and the potentialities of many districts are being re-estimated in the light of present-day commodity costs and abundant labor, to say nothing of unlimited demand for the product at a fixed and fairly satisfactory price. The return of attention to gold mining justifies reiteration of a few fundamental principles underlying metallurgical practice, especially in view of the large number of reports of experimental work being released, containing arguments similar to the following:

> "The ease with which the gold is extracted by cyanide makes the milling of this ore a simple problem; 81.7 per cent of the metal is recovered by amalgamation, but leaves $2.20 in the residue. Cyanidation of this amalgamation tailing would result in the saving of contained values. However, 98.3 per cent of the gold is recovered by cyaniding at the same coarse grinding that yielded 81.7 per cent recovery by amalgamation. This shows that no metallurgical advantage will be gained by employing amalgamation."

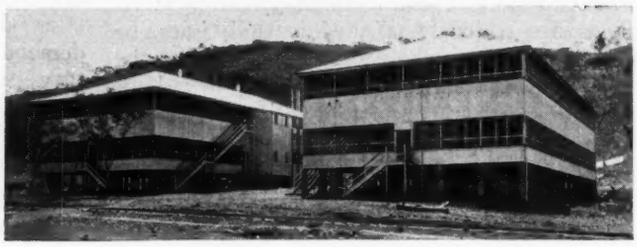
The logic of the conclusion may be questioned. Finely divided gold may be completely dissolved in a cyanide solution, and thus completely extracted; but, when associated with gangue as an average-grade material, such extracted gold cannot be completely recovered by any known combination of metallurgical processes operating on a working scale. All or nearly all of the gold may be dissolved, and a high percentage may be recovered as bullion. The loss of the remainder is all that is needed to influence the contention in favor of efficient amalgamation prior to cyanide treatment of free-milling gold ore. A distinction must be made between the total amount of gold dissolved or extracted and the recovery that may be expected in practice.

If a proportion of the gold in an ore is amalgamable, almost 100 per cent of this proportion is recoverable. If cyanidation replaces amalgamation as a treatment process for this proportion, only from 90 to 95 per cent is usually recovered. In special and exceptional instances the recovery of gold by cyanidation may reach 98 per cent, but in no single instance has a recovery of 100 per cent been recorded with any claim to verisimilitude. No matter how fine the ultimate division of the mixture, a small percentage of the original amount of gold associated with the gangue will remain even after highly efficient displacement treatment.

Assays of tailing after laboratory amalgamation tests may be used to calculate an extraction that will be closely imitated as a recovery in plant practice. Assays of tailing after laboratory cyanide tests provide data for the calculation of the theoretical extraction, to which a reducing factor or factors must be applied to estimate what actual recovery may be expected in practice. The history of the cyanide process is replete with disappointments caused by a neglect to take these factors into consideration. Plant recovery by a hydrometallurgical process is usually considerably less than is indicated by laboratory extraction results, with ideal mechanical conditions, clean solutions, maximum control refinements, and no consideration of losses other than in the tailing or residue.

Improving Industrial Relations in Australia

Charles A. Mitke



"B" and "C" dormitories for miners

A CHAIN is no stronger than its weakest link, and labor is one of the most important links in the chain of industry. Contentment among workers reduces labor turnover and maintains the loyalty of employees in times of general unrest.

In former years, "a fair day's work for a fair day's pay" was presumed to cover all mutual obligations between employer and employee, but today, leading industrialists, including many of those engaged in metal mining, recognize the fact that this is not sufficient; that relations must be less strictly utilitarian, and that "business with a soul, business with a service ideal towards its employees, keeps on paying dividends, in spite of industrial crises, while business on the old basis of exploitation, lies in disastrous ruin." Peace in industry can be accomplished only through harmony, and contented workmen are one of the chief and foremost essentials.

Before the Mining Trust, Ltd., became interested in the Mount Isa Mines, the property had been turned down by other powerful investors, on the grounds that the labor situation in that district was entirely too difficult, and would impose untold hardships on an operating company. The Mining Trust, however, believed that Australian workmen would respond to right treatment, just as American and English workmen do. Consequently, at a very early stage, it formulated definite plans for the health, recreation, and general welfare of its employees.

The lead-zinc-silver camp of the Mount Isa Mines, Ltd., known locally as "Isa Mines" (to distinguish it from the incorporated township of Mount Isa, across the Leichardt River, which had sprung up in a mushroom-like growth when ore was first discovered), is situated 603 miles by rail west of the seaport of Townsville, and approximately 1,500 miles by rail northwest of Brisbane, the capital of Queensland. Mount Isa is in the tropics, the latitude being about 20 deg. 1 min. S. The winter and summer climate resembles that of the Arizona desert, and the heat, though wearing, is not as trying as that on the sea coast, where the humidity is high. The altitude is about 1,200 ft.

When the Mining Trust first became interested in the property, all supplies had to be transported by motor trucks from Duchess, the nearest point on the railway, 54 miles distant. In April, 1929, the line between Duchess and Mount Isa was completed. Now, one fast passenger and mail train, and two freights, arrive and depart each week.

The surrounding country is monotonous, consisting of more or less parallel ranges of low hills, with narrow valleys between. Sparse vegetation covers the hills and valleys. The reddish soil in general is stony, barren, and infested with termites (white ants). Average annual rainfall at Isa from 1926 to 1929 is said to have been 8.64 in. In 1930, however, the rainfall was 26.78 in., the highest individual month being February, 1930, when over 11 in. fell, almost half of the year's total. The 1930 rainfall was quite unusual, and marked the termination of a long period of drought.

In 1928, when the Mining Trust first took over the property, the present site of Isa Mines was a narrow, stony, bush valley, between two lines of low, rolling hills (running north and south), the ridge to the east containing the outcrop of the orebodies. Former prospectors had built five flimsy cottages in the valley, and in the vicinity of the prospect shafts were three or four corrugated iron sheds, used as warehouse, temporary mine office, assay offices, and other essential structures. Otherwise the valley contained nothing but ant heaps; scattered, stunted, "snappy gum" (a variety of Eucalyptus tree); and clumps of prickly Spinifex grass.

With the exception of the occupants of the five cottages, all employees had to find accommodations in the town of Mount Isa, 1.7 miles distant, which was already greatly overcrowded. They had either to drive to work (if a car was

available), or walk, fording the Leichardt River on the way.

No food could be obtained on the lease, and as the district is semi-arid, and a drought had existed for years, no water was available except what the occupants of the five cottages caught off their tin roofs when it rained, and stored in corrugated iron tanks. The residents of the old town of Mount Isa (with the exception of one hotel, which had a well of its own) obtained their water from a community well, paying 5s. per hundred gallons delivered.

MOUNT ISA MINES, Ltd., operating a property in Queensland acquired by Mining Trust, makes an investment that promises to influence favorably the conduct and outcome of a great mining and metallurgical enterprise, and to contribute to the orderly advance of industrial operations in the Commonwealth.

To provide adequate accommodations, both during the construction period and later, when operations commenced, the Mining Trust decided to construct a company town on the leases. As the district was isolated, and long trips were necessary before a change of scenery, altitude, or climate could be obtained, the camp had to be self-contained, so far as amusements were concerned. Moreover, though the winters are delightful, the summers are long, hot, and trying.

The first move was to build quarters for single men. Five dormitories were erected immediately, two small ones for staff men and three large ones for general employees. These accommodated 234 men, but were found to be insufficient, so ten temporary blocks of 20 rooms each were hastily put up, accommodating an additional 400 men.

All dormitories were provided with screened sleeping verandas, running water, shower baths, and lavatories. The temporary accommodations had detached showers and lavatories, the understanding being that the buildings would be remodeled (if their continuance was later found desirable), with screened verandas, running water, and other conveniences added. In November 1930, several of these were remodeled as permanent dormitories; one was to be remodeled as a dormitory for women employees (waitresses in the staff and miners' mess houses and in the club); and another as a row of small stores to accommodate the needs of the camp. The others were left as they were for the time being, as construction work was drawing to a close and many single men were leaving.

Water was an important necessity and was provided by sinking several wells at the north end of the valley, along the river bank. These furnished an adequate supply for domestic purposes. Water from the Rifle Creek reservoir was also piped to the camp.

Two large mess halls were constructed, one to accommodate 50 staff members, and the other, containing both a cafeteria and a coffee room, to accommodate 400. These were large, roomy dining rooms. At the miners' mess, 300 served themselves daily in the cafeteria, an attendant removing the soiled dishes. In the coffee room, where 100 were served, waitresses were in attendance. The same applied to the staff mess. The staff mess and the coffee room cost 35s. a week, and the cafeteria 30s. Rooms in the dormitories, for both staff men and miners, rent for 5s. a week for a single room and 3s. 6d. each person where there are two in a room.

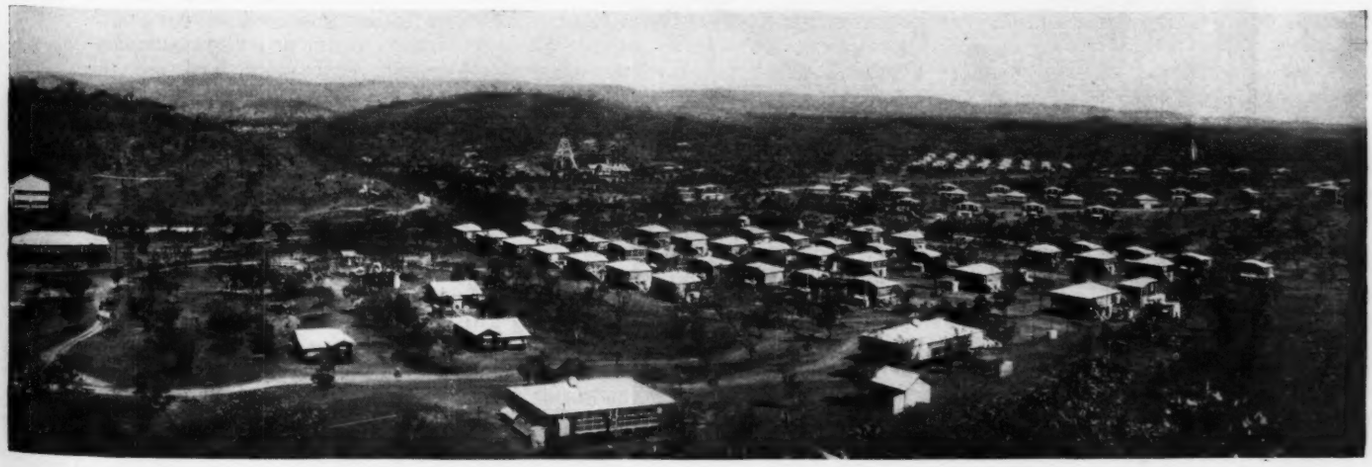
The next move was to provide accommodations for married men, so 140 two-story frame cottages were erected. These were built of weatherboard (brown with white trim), with celotex ceilings and iron roof. They had kitchens, bathroom, and lavatory downstairs, and bedrooms and large screened-in sleeping verandas upstairs. All houses, offices, and dining rooms are screened against flies and mosquitoes. In addition to the house fly, there is the "bush fly," which is attracted by cattle or the green Spinifex grass in the spring and summer. Although only half the size of his domesticated brother, he is twice as persistent, and his bite often results in swollen eyelids. Screening all buildings, and burning the brush in the vicinity of the camp in spring time, reduced this annoyance to a minimum.

Running water, electric lights, and septic tanks for lavatories were provided for each house. The houses ranged in size from two to five rooms. They rented at prices ranging from 10s. to 17s. 6d. per week, with lights, water, and garbage removal included.

Five Australian bungalows, with wide verandas on all four sides, and thirteen brown and white California bungalows,

Panorama of Mount Isa Mines

At the extreme left is the Davidson shaft of the Black Star orebody. A little to the right is the Man shaft, and still farther to the right, adjacent to the dump, is the O'Doherty shaft of the Black Rock orebody. In the right half of the panorama is seen the Lawler shaft, tapping the Rio Grande orebody, with the miners' houses in the foreground. The mill is in the saddle of hills, out of sight. The smelter is below the mill in an adjoining valley; the top of the smelter stack is just discernible at the right of the left half of the panorama.



each with bathroom, screened sleeping, and living verandas, and attached wash house, were constructed for the married members of the staff, and rented at prices ranging from 17 to 28s.

The 140 miners' houses proving to be insufficient, 25 small, temporary, two-room and kitchenette iron houses, with concrete floors, were built, and rented for 5s. a week. These had detached community bathrooms and lavatories in the rear.

To provide for married men who were unable to find living quarters elsewhere, 61 double tents, connected by a canvas fly—making three rooms in all—with board floors, were set up, similar to an auto camp in the States. Running water was piped to convenient points throughout the "tent city," and community showers and lavatories were provided at regular intervals. These were also rented at 5s. a week, and were in great demand.

The necessity for stores on the lease soon became apparent, as, although the Leichardt River is practically dry most of the year, it has a disagreeable habit of becoming unfordable for days at a time, without warning, during the rainy season. Heavy rains at the headwaters of the river travel down in an hour or so, and the river overflows its banks to such an extent that crossing is practically impossible. Consequently, a company store was erected and opened on the mining lease. A butcher shop, with ice plant adjoining, was also constructed, and a druggist and fruiterer were given quarters. As much as 7½ tons of fruit and vegetables a week, from the markets in the south, were consumed by residents of Mount Isa during the latter part of 1930.

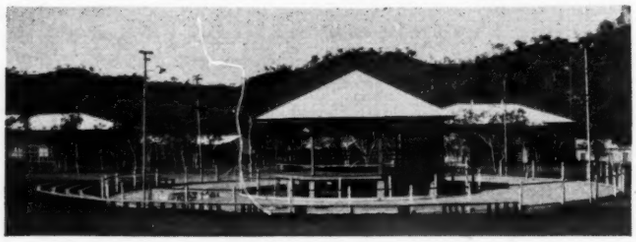
Ice was delivered to all homes daily, and groceries were delivered twice a week. Arrangements were made for a house-to-house delivery of mail from the postoffice in the township across the river, and a branch of the Commonwealth Bank was opened in the store. Although the store was a "cash and carry," with only two deliveries a week, coupon books, in denominations of £1, £2 and £4, containing coupons ranging from 6d. to 10s., acceptable anywhere on the lease, were obtainable from the mine office (paymaster's department). These were chargeable against wages, and provided an acceptable form of credit between pay days.

As the entire surface of the valley was made up of eroded shale and greenstone pebbles, which made walking difficult, streets were surveyed and spent ash from the boiler plant was spread over the surface. This made walking much easier and gave the appearance of a macadamized road. Street lights were also put up in the immediate vicinity of the club, store, mess halls, and along the road leading to the dormitories.

The company, having provided for the general welfare of its employees, also recognized the wisdom of providing facilities for their health and recreation. A temporary hospital, with nurses' quarters adjoining, was erected, and plans were drawn up, and work was started, on a permanent hospital. In "outback" regions in Australia, in farming districts, and suburban points, hospitals are what is known as "district hospitals." These are supported partly by contributions from local residents, who become contributing members, and partly by the government. The management of the hospitals, including engagement of physicians, matrons and nurses, is directed by a local committee, frequently inexperienced. Often, various factions or unions try to obtain control of the committees, and use the hospitals for their own ends, the hospitals and patients suffering as a consequence. The Mount Isa Mines, Ltd., therefore decided to operate a company hospital, directly under the supervision of the management, similar to numerous hospitals at mining camps in the States, and to build up an organization that would provide the same efficient and satisfactory service.

Recreation was the next important item on the program. A sports ground was cleared, and space provided for football, cricket, and American baseball. As Australians are keen cyclists, a

A general view of the refreshment and card room



Band rotunda, with dormitories at rear

One of the verandas of the clubhouse

bicycle track was added around the sports ground. A nine-hole golf course was laid out, enthusiastic players clearing and burning brush while the company contributed a small amount of assistance. Tennis courts were also constructed.

A band rotunda was built in the center of a space reserved as a central park, and a circle of concrete laid around it, for dancing and roller skating. As the park sloped naturally to the rotunda, in the form of an amphitheatre, benches were set up outside the concrete, so that open-air entertainments might be given, these being possible almost the entire year.

The great problem was to amuse the 600 single men. The married men and many of the staff members enjoyed comfortable homes and the society of their families. But the single men had nowhere to go after their evening meal except back to their dormitory rooms or over to the old town, where they naturally drifted to the saloons or collected in groups and were entertained by malcontents with the gift of oratory.

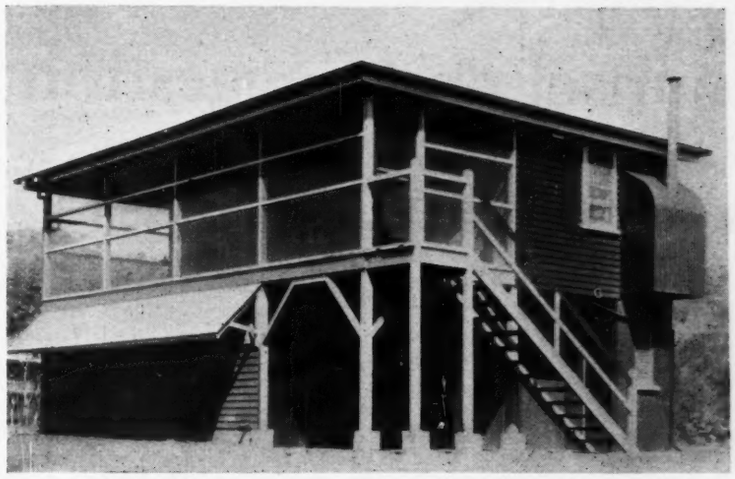
A large roomy frame clubhouse, about 20x80 ft., with two wings extending in the rear, about 30x60 ft., and a 12-ft. veranda all round, was therefore constructed. This contained a large general card and refreshment room in front, with one end for ladies. A counter ran about one-third the length of the room, with two soda fountains, where fresh fruit, squashes, soft drinks, tea, coffee, milk, ice cream, sandwiches, salads, fruit, sweets, and tobacco could be purchased at extremely moderate prices. A large variety of soft drinks were sold for 3d. a glass, with coffee and sandwiches at 6d. No alcoholic drinks were served on the premises.

The building contained a barber shop, large billiard room with three tables, circulating library with 600 volumes, and a reading room capable of seating over 100 men. This was supplied with magazines and newspapers from all parts of Australia and certain points overseas.

The roomy verandas, with their easy chairs, resembled the deck of an ocean liner, in that they were provided with "deck quoits," "bucket quoits," "ping-pong tables," and "deck tennis." A notice board on the wall contained the latest telegraphic news and important items of local interest. Members could also have their mail delivered to the club.

Membership in the club cost 1s. 6d. a month, or 12s. a year, and subscriptions to the circulating library, permitting the changing of books as often as desired, cost 3s. for three months, 5s. for six months, or 8s. for a year.

The club was formally opened in September, 1930, and by the middle of December there were 850 members. It was a busy place, and additions had to be made to the staff continually. On a Sunday night, after the band concert, the men would be lined up at the soft drinks' counter three and four deep. Entertainments and card parties were given at times, and illustrated lectures on tunnel driving by members of the staff. At least 300 men would be present at one of these entertainments. When the glee club entertained, and the men were asked to join in the choruses, rousing times resulted.



Typical employee's house at Mount Isa, with provision for shaded kitchen on ground floor, with screened verandah and living rooms on second floor. This dwelling is rented by the company at a low rate.

The "Isa Mines Concert Band" was organized, with 22 members, and instruments were purchased. Within a few weeks, the band (most of the members of which had formerly played in bands elsewhere) was able to give semi-sacred Sunday night concerts at the Rotunda, which were well attended. Encouraged by its success, several other musical organizations sprung into existence, and open air concerts became frequent. Calls were sent out for local talent, with a remarkable response, the janitor of one of the dormitories proving to be a star performer. Singers from the outside, visitors to camp, also contributed their services liberally.

Amateur boxing contests were held at the Rotunda every fortnight, dances on the concrete once a week, and roller skating was enjoyed on evenings not otherwise engaged.

Another innovation was the issuance of the *Isa Mines News,* which came out every Friday evening. It contained three or four mimeographed sheets, distributed free to employees, giving safety-first activities, sports, club news, local items, and telegraphic news from the outside.

In addition to these social activities, an opportunity was given whereby requests and complaints of individuals or groups might reach and have the sympathetic consideration of the management. This provided for a closer contact with the men generally, many of them, on being granted an interview, stating that they came merely to satisfy themselves that they would be given a hearing by the "man at the top" in case occasion demanded it.

Much has been done for the health and contentment of employees, but the cost was relatively small. Little labor trouble has occurred at Isa, though the rest of Australia is torn by industrial strife. Many improvements have thus been possible, all of which helped to expedite the completion of the general plans and bring the mine to a producing basis much earlier than if old-time methods, with their intermittent strikes, had prevailed.

The former custom in Western Queensland camps was for a general migration at Christmas time. Every one who could afford it went to the coast or elsewhere for two or three weeks, and the mines, as a consequence, had to shut down until they returned. During the last two Christmas weeks Mining Trust has provided community Christmas trees, with small gifts for all children under a certain age; picnics, field days for all forms of sport and racing, and other forms of entertainment. As a consequence, fewer and fewer men leave the district at that time, and the mine has closed down on only the three important holidays—Christmas Day, Boxing Day (Dec. 26), and New Year's Day.

Saturday afternoon work (both on surface and underground), which has been unknown in Australia for many years, has been resumed, and underground, in important drifts, men are working three shifts, seven days a week. During October, 1930, an Australian record in drifting was established when 469 ft. was driven in a 9x9-ft. drift, on the 350-ft. level.

The considerate treatment of employees at Mount Isa is but the natural reflection of a practice which has met with success at other large mining camps, and has abundantly proved that the cooperative spirit between employer and employee works difinitely to the advantage of both.

Counsel and Suggestion to a Graduating Class

ABSTRACT of an address at the commencement exercises of the Missouri School of Mines, Rolla, Mo., delivered by Dean Frank H. Probert of the College of Mining, University of California

RUDYARD KIPLING, in the introductory remarks of his inaugural address as rector of St. Andrews University, said: "The sole revenge that maturity, even old age, can take upon youth for the sin of being young, is to preach to it." I fear at times we academicians overwork this prerogative, and frequently fail to elicit response because of reiteration of statements that have done weary duty on a thousand platforms. It is not my purpose to preach to you a lay sermon on the threadbare theme of "elements of success." In my enthusiasm, however, I may yield to temptation. Sir Francis Bacon claimed that it is the nature of the mind of man to delight in the spacious liberty of generalities, to the extreme prejudice of knowledge. Granted: but the things of which I speak are ubiquities though simplicities. Innocent or elegant information is of little value unless it be useful. To be effective, the lamp of knowledge must be kept burning brightly so that we may see what we are, where we are, and whither we are going.

An ancient legend popularized by Sienkiewicz tells that Peter, fearing persecution and fleeing from Rome along the Appian Way, was halted by the apparition of the Christ, and that in utter bewilderment the apostle exclaimed "Domine, quo vadis?" It seems to me this question "Whither goest thou?" is peculiarly appropriate for each of us to ask the other on this Commencement Day. For many of you the destination is unknown and the itinerary uncertain. Fickle fortune will smile on some of you; it may frown on others. For all of you the way is long, the goal is far; bypaths and shortcuts mean failure or fraud; along the uncharted course are rough tracks and treacherous swamps; but, in pressing forward toward the goal of our high calling, righteous toil is never vain.

The glorious adventure awaits you. Are you prepared to meet it? What have you in your kit bag? The common necessities of life, of course: suits well pressed and spotless linen. How intimate and personal, yet how important these things are. Carelessness in dress, untidiness in appearance, may retard your progress at the very outset. First impressions are often lasting and difficult to offset, no matter what concealed force or virtue you possess. The personal ensemble unerringly portrays the refinements of the mind. A man sloppy in habit is prone to be muddy in intellect. Neatness is evidence of carefulness, and carefulness generally denotes accuracy.

You are seeking professional contacts. What are the avenues of approach thereto? Occasionally by personal interview, but more frequently through the medium of correspondence. How sad it is that the most useful of all our effective tools, our mother tongue, is the one most neglected. Unless you have a ready command of English you are severely handicapped. To be able to express your thoughts orally or on the written page in a convincing manner and correct form is a great accomplishment. It means much. Learn the meaning of words. Clear thinking precedes clear statement, and voicing thought often clarifies ideas. What woeful waste is caused by poor enunciation in telephone or business conversation. What misunderstandings flow from ambiguous phrases. What irritation from misspelled word or misplaced comma. How costly are the errors of an incompetent stenographer!

Avoid spurious coin; shun slang. We should be abashed rather than amused by these atrocities on the fine art of language. Words are not only vocal sounds but vital forces. It is true today as when John Ruskin wrote sixty years ago that "The secret of language is the secret of sympathy, and its full charm is possible only to the gentle." With these commonplaces you are already familiar. Much that is true is not new, and most that is new is not true.

During your college life you perhaps have spent much time worshipping at the altars of false gods; you have found relief for pent-up energy and enthusiasms through the safety valves of athletics, social functions, student politics, and other extra-curricular activities. Sometimes these things lead to hysteria and nervous exhaustion, to such an extent that educational shipwreck may have threatened you. I congratulate you on these indulgences so far as they have been wholesome; but in all things we need balance, a sense of proportion, and true perspective. I caution you that popularity is not the gage of competency, nor does prominence in student life assure the realization of your more serious hopes and ambitions.

He amongst you whose vest sags under the weight of golden keys and brazen symbols, perhaps the envy and cynosure of campus eyes today, may not be the outstanding alumnus of your class ten years from now.

Youth is no longer demure or unsophisticated. You are wise with worldly wisdom, you know of life and living, and surely a university must teach us how to live and grow as well as how to make a livelihood. I do not deplore these things; they have utilitarian value, but when overdone they suck the vitality out of education. However, the future of world progress rests squarely upon the shoulders of youth, and I have an abiding faith that you will meet the challenge of changing times. The youths of a nation are the trustees of posterity, and the sagacious remark of Disraeli bears repetition: "The blunders of youth are preferable to the triumphs of manhood or the success of old age."

In what other manner are you equipped for life's uncharted cruise? Your prime object at Rolla has been to start your education along directed lines. I say start, for education must be conceived not merely as a preparation for maturity but as a constant growth of the mind and a continuous illumination of life. God never meant that man should scale the heavens by giant strides

of wisdom. There must be continuous humility as to our lack of knowledge on every question we touch. The true object of education is not to load the young mind with doctrine, to weigh it down with fact, but to excite it. You came here to breathe the bracing ozone of imagination, forsaking the petty troubles of the street to walk in hallowed cathedrals of science and art and literature, to dwell awhile in temples of learning, wherein men think great thoughts and develop those qualities of leadership that come from knowledge and ideals.

Sixty years ago the Missouri School of Mines, through the wisdom and foresight of the General Assembly and the benevolent act of the Congress of the United States, was established at Rolla as an integral part of the University of Missouri. The statutes of your State prescribe its purpose to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life, and your several curricula testify to the zeal with which the executive board and faculty have discharged their responsibility. The dreams of the sponsors are today expressed in durable structures, appropriately equipped. Gratifying as these things must be to you, to your community and the State at large, the fact deserves emphasis that magnificence of buildings, completeness of equipment, excellence of libraries, and the advantages of environmental facilities count for little or naught. Not in them is the vital spark, but in the wisdom of the teachers and the virility of the taught: these send life blood pulsing through your body corporate, and breathe into the institution the spirit of progress. Your academic family is not so large that individualities are lost. Surely in this atmosphere there must be much of happiness and intimacy.

Since the immigrant hordes of white men wrested the terrain from the redskinned native sons of America, the policy throughout the United States has been to encourage exploitation of our resources and prepare the citizenry, by provision of adequate educational facilities, for their manifold tasks. No other nation is so abundantly blessed in this regard; universities and technical schools publicly supported or privately endowed receive in increasing numbers those who can meet the reasonable requirements of matriculation. Many think that higher education is overdone, that it is subversive of its true purpose. Public approval greeted the courageous remark of President Hopkins of Dartmouth College that "There is an aristocracy of brains made up of men intellectually alert and intellectually eager, to whom increasingly the opportunities of higher education ought to be restricted, if excellence and effectiveness are to displace the mediocrity toward which democracy has such a tendency to skid." The emphasis too is so often misplaced. The technique of exploiting the land for gain is assiduously taught, and in the tenet of faith that happiness lies in worldly success, that peace comes from profits, the hectic scramble to amass a fortune dwarfs the desire for mental growth. We who make these statements, and you, young men, who I am confident will sooner or later subscribe to them, must beware lest the obsession for material things obscures the goal for which we strive.

Training for the engineering profession, perforce though perhaps unfortunately, is somewhat circumscribed and specialized; for it you are well prepared. Precision, accuracy, exactness are your guiding principles. You are iconoclasts, pragmatists. You think along straight lines. You deal with practical values and consequences. To the engineer truth is that which works. All engineering work is based upon sound scientific knowledge. The intellectual growth of science has no less wonderful practical expression. Joseph Priestly in 1790 dedicated his great work "Air" with the foreword, "It is by increasing our knowledge of nature, and by this alone, that we acquire the great art of commanding it, of availing ourselves of its powers, and applying them to our purposes, true science being the only foundation of all the arts of life distinguishing civilized people from the barbarous." Man's interpretation of the laws of nature is always subject to revision.

Nevertheless, Nature's verities are eternal. She knows no miracles, and the constancy of her order is the fundamental axiom upon which all physical science rests. To the scientist, however, the heresies of today become the orthodoxies of tomorrow, when the theories of bygone summers have fallen as leaves from a tree, blasted by the bite of cold criticism. Every science arises in hypothesis and flows into achievement. Scientific truth has been advanced by scientific error. The thoughtful observer realizes that, as the border line between the known and unknown is pushed back, its dimensions increase. The resolute work of engineering recognizes the generative supremacy of pure science, and the perennially existent necessity of insuring its advance.

I plead with you to keep abreast of the wave of scientific thought, to see to it that you do not so earnestly devote yourselves to the monotonous routine of an assigned task that you lose desire or opportunity for mental recreation. The psychologists may take exception to the jeremiad of Schiller, that their science, after 2,000 years of strenuous cultivation, still has no laws, but only technical terminologies; but the engineer makes obeisance to the shrine of science, marveling at the wondrous changes it has wrought. The penetralia of Nature have always excited man's curiosity. With persistent inquiry have great truths been revealed. Diverse as are her processes, science tends more and more to reveal to us the unity that underlies them all.

Only live fish swim upstream. If you are to progress you must maintain your inquisitiveness. Much investigative work remains to be done, and the spirit of research must be part of the paraphernalia you carry with you. No branch of science advances by itself. Let your intellectual aspirations have room to grow; purge your thoughts of prejudicies; remember that science kills credulity. Descartes suggested long ago that the scientist reduce himself to a condition of intellectual nakedness and pointed the necessity of methodic doubt as being the cobweb-clearing prerequisite of honest thought. More recently Mr. C. F. Kettering, president of General Motors Research Corporation, said "A research worker with intelligent ignorance of a subject is likely to get results more quickly than he whose natural gift of creative thinking has been dulled into insensibility by the very weight of the data he has accumulated by study." I will admit that polemics and casuistry have no place in strictly engineering work, work built upon incontrovertible premises that point to but one conclusion; nevertheless, it is part of our field to assist in the enunciation and elucidation of these basic principles, to determine the definitive findings of research. Pure and applied science melt into one another, and either loses virtue if dissociated from the other. We proudly boast of superlative technology and excellence of technique in production practices; indeed, in large measure because of them, our markets are glutted with goods we can neither dispose of nor devour. The glare of accomplishment has blinded us to the fact that mere volume counts for little. Mass has become master rather than servant. Output exceeds the established marts of consumption. What fields lie fallow here waiting your attention and genius! Remember that

> "New Times demand new measures and new men.
> The world advances, and in time outgrows
> The laws, which in our father's day were best"

You cannot afford to look at the future with myopic eyes: early specialization impedes progress; it may lead to extinction; for, when environmental conditions change, the survival chances of specialized types diminish. The stereotyping of some process is only fruitful for an allotted time. I read recently of a man being likened unto a tack; useful if he has a good head and is pointed in the right direction, but even though driven hard he can only

go as far as his head will let him. I beg of you do not wear the fetters of formulas. An education should liberate and elevate a man's soul from the bondage of convention, recipe, and ruts.

Being of the older European school, I wonder whether by devoting so much of time and energy to practical things we have not lost something of the mind, of wisdom, and true understanding. Thomas Henry Huxley, under whom I was privileged to study, said that "An exclusively scientific training will bring about a mental twist as surely as an exclusively literary training. The value of the cargo does not compensate for the ship being out of trim. We must not turn out lop-sided men." We have in large part discarded the classic disciplines of older schools and substituted therefore subjects adapted to the greatest usefulness. We have departed from the theory that the classicists alone held the key to intellectual freedom, that their dicta were the sole guides to truth and the supreme arbiters of conduct. To maintain that the root of all knowledge lies deep in dead languages is as fatuous as it is fallacious, in these days of the marvelous and satisfying interpretations of the laws of the cosmos. If we espouse the cause of the school of humanists—that intimacy with the classics promotes competency in literary expression—surely it is debatable whether Horace and Homer will inoculate us with literary culture if we are immune to the powerful virus of the language of the Bible, of Milton, or of Shakespeare.

The world still acclaims the noble character and masterful intellect of Abraham Lincoln, but when Dr. Bateman, president of Knox College, asked Lincoln how best he could describe his education, he tersely replied "defective." I tell this to excite your imagination to the infinite opportunities of continuous intellectural growth, that you may know the lasting satisfactions of life.

Nurture your minds with great thoughts. Reading doesn't replace living; but it makes life vastly richer. One wants to adorn his mind with opinion, and satire, and whimsy, and tragedy, and beauty. Indulge your leisure with truant reading, to round out your education. Read that which is worth while. A Spanish proverb, *Libros y amijos pocos y buenos* — "Books and friends should be few and good." Sir Francis Bacon admonished us that "some books are to be tasted, others swallowed, and some few should be chewed and digested." He also advised us to read "not to contradict and confute, nor to believe and take for granted, nor to find talk and discourse; but to weigh and consider."

Scholarship is not only the knowledge that makes books but the wisdom which inspires that knowledge. The sublime scholarship of John Milton began in literature and ended in life. Wherever you go, into crowded cities or to the vast solitudes, see to it that some gems of literature are your constant companions. They will never fail you. I would like, before dismissing this subject, to point out to you the inspiring benefit that comes from acquaintanceship with the masters of bygone days, the alchemy of their influence. To live again with Socrates must make one wise: with Francis of Assisi, gentle: with Michael Angelo, appreciative of delicacy of line and strength of form; and to walk in spiritual comradeship with Leonardo da Vinci will reveal to you the infinite beauty of the universe, and with stoop of soul you will find God.

In the alembics of our academic laboratories are distilled the elements upon which our professional and spiritual life depends. You have been nursed and nourished in a cradle of culture. The greater part of your lives has been spent in absorbing the knowledge of others. Here you have been led; henceforth you must lead. You already know there is no magic in learning. Drudgery, exasperation, exhaustion, often want, are the teachers of wisdom. Difficulty is the nurse of greatness, the true interest of knowledge lies in its growth. In order that the mind may measure the full compass of its possibilities, it must grapple with great aims and wrestle with weighty questions. Patience and diligence, like faith, can remove mountains. To be cultured is to know the best that has been thought or said by scholars of the past. Listen to the words of Eliot of Harvard spoken at his inaugural: "The worthy fruit of academic culture is an open mind, trained to careful thinking, instructed in the methods of philosophic investigation, acquainted in a general way with the accumulated thought of past generations and permeated with humility. Reverently give welcome to the revelation of your own taste and capacity."

An Oxford don defined education as "what remains behind when you have forgotten all that you have learned," to which President Hibben of Princeton replied, "What is it that remains behind? A mind: a tempered and skilled instrument of realizing the processes of the will; a depository of ideas gained from study, contemplation, and experience; a creative power to make possible the things regarded as impossible, surmounting obstacles that are regarded as unsurmountable; a discerning faculty separating the essentials from the unessentials in a mass of confused and chaotic facts, penetrating to the heart of a subject in any new and unfamiliar situation: a mind that is the enemy of sophistries, of loose thinking and of hasty and ungrounded generalizations. This is what remains behind; this is the product of education: man noble in reason and infinite in faculties."

We live in an age of throbbing industry, wherein the cultivation of leadership in the body politic is of utmost importance. Today, however, as throughout human history, man's greatest problem is himself. Never did the world call more loudly for men of broad vision and deep understanding; never before was there such need for quantitative analysis of factors and forces operative in business enterprise; never before were engineers, well trained, experienced, mature in thought and judgment, in greater demand. For the mining engineer there is no geographic horizon to his sphere of work and influence. His life is essentially nomadic:

"West of the sunset stands my house
There, and east of the dawn;
North to the Arctic runs my yard:
South to the pole, my lawn."

A feeling akin to exultation possesses you as you head from this haven of learning and set your course for the open sea. I have no fear at your departure, for while I know the wise gods have put difficulty between man and everything that is worth having, I also know that

"Go where he will, the wise man is at home,
His hearth the earth, his hall the azure dome."

Think independently, act resolutely, fear nothing. Your ideals will be to you as the stars. You cannot touch them with your hands—you choose them as your guides; and following them you reach your destiny. Nail to the masthead the flag of honor and truth, to fly there through calm and storm.

GEAR OR PULLEY RATIO CHART

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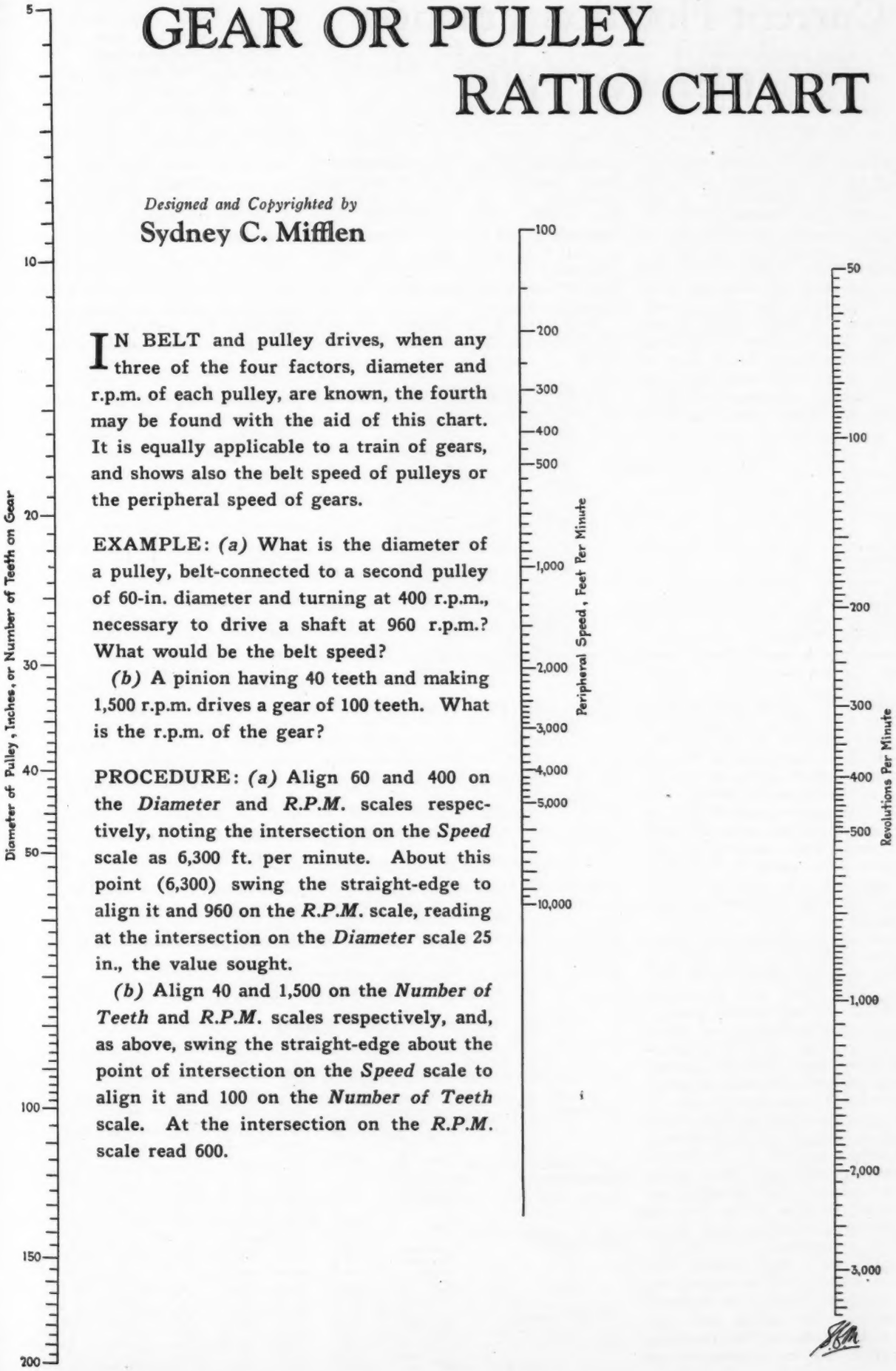
Sydney C. Mifflen



IN BELT and pulley drives, when any three of the four factors, diameter and r.p.m. of each pulley, are known, the fourth may be found with the aid of this chart. It is equally applicable to a train of gears, and shows also the belt speed of pulleys or the peripheral speed of gears.

EXAMPLE: *(a)* What is the diameter of a pulley, belt-connected to a second pulley of 60-in. diameter and turning at 400 r.p.m., necessary to drive a shaft at 960 r.p.m.? What would be the belt speed?

(b) A pinion having 40 teeth and making 1,500 r.p.m. drives a gear of 100 teeth. What is the r.p.m. of the gear?

PROCEDURE: *(a)* Align 60 and 400 on the *Diameter* and *R.P.M.* scales respectively, noting the intersection on the *Speed* scale as 6,300 ft. per minute. About this point (6,300) swing the straight-edge to align it and 960 on the *R.P.M.* scale, reading at the intersection on the *Diameter* scale 25 in., the value sought.

(b) Align 40 and 1,500 on the *Number of Teeth* and *R.P.M.* scales respectively, and, as above, swing the straight-edge about the point of intersection on the *Speed* scale to align it and 100 on the *Number of Teeth* scale. At the intersection on the *R.P.M.* scale read 600.

Current Flotation Practice at Broken Hill

DEVELOPMENT of ore-concentration methods at Broken Hill, New South Wales, is discussed in a joint paper prepared by Broken Hill metallurgists and recently published by the Australasian Institute of Mining and Metallurgy. The authors state that four milling plants are working on the Broken Hill field: The Zinc Corporation, Broken Hill South, North Broken Hill, and The Sulphide Corporation, though the last-named closed down at the end of 1930. Until about two years ago the common practice at all plants was to crush to 4 mm. in rolls, de-slime, a tailing, the tailing being subsequently treated in mechanical flotation machines selectively for lead and zinc, giving a final residue. Zinc concentrate thus produced carried whatever coarse galena was left in the pulp, and so was tabled, producing lead concentrate, zinc concentrate, and a middling which was retreated by flotation.

Since June, 1929, however, practice has changed to some extent. Until recently, all companies used a sulphuric acid circuit. B. H. South and Zinc Corporation have gone over to an alkaline circuit, the former using soda ash, and the latter, lime. North B. H. has eliminated jigs and tables. At this plant, after the ore is ground in tube mills, it is classified into sand and slime and each portion is floated separately.

Table I

	Zinc Corporation			B. H. South	
	Slime Lead	Slime Zinc	Coarse Zinc	Slime Lead	Zinc
Soda ash	.....	.....	.....	.....	1.66
Lime (hydrated)	.....	.....	0.76	.....	.....
Sodium silicate	.....	.....	.....	0.51	.....
Eucalyptus oil	0.027	0.034	0.163	0.113	0.50
Vallo "C" oil (*a*)	0.017	.....	0.027	.....	.....
Roylo "C" oil (*b*)	.....	.....	.....	.....	0.079
Potassium xanthate	0.04	.....	.....	0.03	0.122
Aero cyanide	0.358	.....	.....	.....	.....
Copper sulphate	.....	0.878	0.783	.....	1.23
Sodium "Aerofloat"	.....	0.171	0.305	.....	.....

(*a*) A compound of an essential oil and a chemical reagent; (*b*) a coal-tar distillate.

Reagents currently used by the two companies having alkaline pulps, in pounds per ton of ore, are given in Table I.

In discussing the use of the above reagents, R. D. Nevett, of the Zinc Corporation, stated, in reply to a question as to whether soda ash would depress pyrite equally as well as the cyanide does, that he had tried soda ash for lead flotation in every way that he could think of, but results were not equal to those when using cyanide. Zinc seemed to float more easily with soda ash than with cyanide. The addition of lime, he explained, was not to depress the pyrite in the lead section; it was added to the deleaded tailing to keep pyrite out of the zinc concentrate. Asked if xanthate could be used instead of Aerofloat, Mr. Nevett said that at Mount Morgan lime and xanthate were used for copper flotation and that by varying the amounts, as much pyrite could be floated as was desirable. At Broken Hill where no pyrite was wanted, his experience had been that more pyrite was floated with the zinc concentrate when xanthate was used than when lime and Aerofloat were used with copper sulphate and eucalyptus oil. Cyanide had no effect on silver recovery. The use of a depressant to keep down the pyrite has a tendency to depress some of the zinc as well, with consequent loss in recovery but an improved grade of concentrate results. Subsequent discussion developed the fact that what had been called "pyrite" in the Zinc Corporation's ore was almost entirely pyrrhotite, and the foregoing statements should be considered with that fact in mind.

Mechanical types of flotation machines have been used by all of the companies in preference to pneumatic cells, which have not found favor for the heavy sulphide ores. These include Seale & Shellshear horizontal boxes, Fahrenwald Sub-A., Minerals Separation Sub-A., Hebbard Sub-A., and Bradford boxes with Henderson pumps. Hebbard and Seale & Shellshear cascades are also used.

Flotation tailing is used for mine fill at Broken Hill, so it must not be too fine. A balance must therefore be struck between metallurgical recoveries and grain size of residue, so as to produce a final tailing from which sufficient coarse sand can be classified out to supply the mine with filling.

Typical metallurgical statements showing the work of the Broken Hill concentrators near the close of 1930 are shown in Table II.

and remove the coarse galena as a high-grade lead concentrate, using May Bros. jigs. The jig tailing was then ground to 3 to 6 per cent on 40-mesh (I. M. M.) screen, after which the practice of the companies varied. The first three companies named then deslimed and tabled the sand, producing a high-grade lead concentrate, and floated the table tailing in lead scavenger machines. The slime was thickened and fed to the selective lead flotation machines.

Two of the companies then floated the de-leaded slime for zinc, producing a slime zinc concentrate and final residue. The slime zinc concentrate was added to the table tailing from the lead scavenging machines, and floated to produce a zinc concentrate and a final sand residue. The zinc concentrate was cleaned to improve the grade. North practice was to float at 120 deg. F., whereas the Zinc Corporation operated at atmospheric temperature.

The third company (B. H. South) combined the de-leaded slime tailing from the selective lead flotation machines with the table tailing from the lead scavenging machine, and floated the whole to produce a primary zinc concentrate and a final residue, with subsequent cleaning of the concentrate.

The Sulphide Corporation thickened the reground jig tailing and then floated in a cascade machine, producing a high-grade fine lead concentrate and

Table II

Company	Products	Per Cent Weight	Assays: Per Cent Pb	Assays: Oz. Ag	Assays: Per Cent Zn	Proportion of Metals: Per Cent Pb	Proportion of Metals: Oz. Ag	Proportion of Metals: Per Cent Zn
B.H. South	Lead conc.	20.4	68.9	24.5	6.0	95.1	91.2	10.6
	Zinc conc.	19.3	2.0	1.5	50.1	2.6	5.4	84.3
	Tailing	6.03	0.7	0.3	1.0	2.3	3.4	5.1
	Feed	100.0	14.8	5.5	11.5	100.0	100.0	100.0
North B.H.	Lead conc.	18.1	70.0	39.8	5.7	94.1	86.5	10.1
	Zinc conc.	17.0	2.0	2.8	50.3	2.5	5.7	83.6
	Tailing	64.9	0.7	1.0	1.0	3.4	7.8	6.3
	Feed	100.0	13.5	8.3	10.2	100.0	100.0	100.0
Zinc Corp.	Lead conc.	19.4	73.2	16.4	5.0	93.4	91.4	8.6
	Zinc conc.	19.3	3.3	1.0	50.7	4.2	5.6	85.8
	Tailing	61.3	0.6	0.2	1.1	2.4	3.0	5.6
	Feed	100.0	15.2	3.5	11.4	100.0	100.0	100.0
Sulphide Corporation	Lead conc.	18.2	68.3	53.8	8.1	92.9	85.2	10.4
	Zinc conc.	22.4	2.1	4.2	53.2	3.5	8.2	84.7
	Tailing	59.4	0.8	1.3	1.2	3.6	6.6	4.9
	Feed	100.0	13.4	11.5	14.1	100.0	100.0	100.0

Increasing Steam-Heat Dryer Efficiency

STEAM is regularly used in the non-metallic mineral industries for drying the raw or prepared material necessary in the manufacture of china, glassware, abrasives, paints, and many other products; direct-fire drying is undesirable because of the contamination resulting. Steam coils are employed in many phases of mining and metallurgical work, for general heating purposes, and, for example, to thaw frozen concentrate. Where winters are severe, a thaw shed may be provided, equipped with steam coils, through which the cars pass before unloading. In all these applications one major disadvantage results, although it is seldom realized: the coating of the interior of the pipe with a crust of oil products, from the steam, that seriously retards heat transfer. The author of the article here presented describes an efficient, economical and simple remedy.

Dipl.-Ing. P. Erimescu

A NEW METHOD of cleaning the coils of steam-heated dryers has been adopted to date only in connection with the drying of lignite, but it is applicable to dryers used for other purposes. It is suitable for removing oil and grease from any metallic surface, however complicated the construction of such a surface may be.

In the lignite plants the efficiency of the dryers, both the rotary and the plate-type, declined after a few years 30 to 40 per cent. Impurities, contained in the steam, form an insulating crust on the heating surfaces, which lower the drying capacity. Removal of this oil-resin crust was a difficult and expensive operation, necessitating a shutdown, with loss in production. As the lignite industry is of vital importance in many countries, especially in Germany, and recently in Russia, much effort has been expended to remedy this situation. After extensive experimentation, a chemical method of removal, of high efficiency and low cost, was developed by Wolf, involving dissolution of the crust with trichlorethylene, C_2HCl_3, called "tri," and regeneration of the solvent by distillation. The method offers many advantages. The used "tri" may be recovered, the substance is not poisonous or inflammable, and it is inexpensive.

A large open-pit lignite mine in central Germany, with a power plant of 140,000 kva. and a plant for recovery of the chemical byproducts from the lignite, applied this method to four plate dryers, subsequent to two weeks' tests to determine the performance before cleaning, with varying steam temperature and speed of rotation, in order to secure a basis for reliable comparison with the performance after cleaning. The arrangement of the cleaning and regenerating plant is illustrated in the accompanying flowsheet. The "tri" is forced from Tank 1 to the dryer with a centrifugal pump. Three to four plates are put in closed circuit with the cleaning device by blind flanges against the steam pipe. A slight reduction in feed is necessary to allow for the diminished heating surface. This reduction, is however, so small that only a negligible loss in production occurs. The solvent, saturated with the oil-resin impurities, flows by gravity or suction to Tank 2, and then to the distillation apparatus and through the cooling tank to the storage tank, ready for continued use. The tanks are equipped with spigots, where samples are taken to check the degree of saturation. The "tri" is forced through the plates until they are clean. Average time for cleaning four plates of 3,000 mm. diameter is 24 hours. To remove residual "tri" steam or compressed air is forced through the plates when clean. In the manner described one group of plates after another is cleaned without interrupting the operating routine.

In spite of devices for removing oil from steam, it always contains some contamination. The four dryers referred to were in operation for fifteen years before they were cleaned by this method, and a large amount of impurities was removed, in spite of the fact that mechanical methods of cleaning had been used at several occasions. The tar-like residue of distillation averages about 50 per cent moisture, contained as globules in the crust.

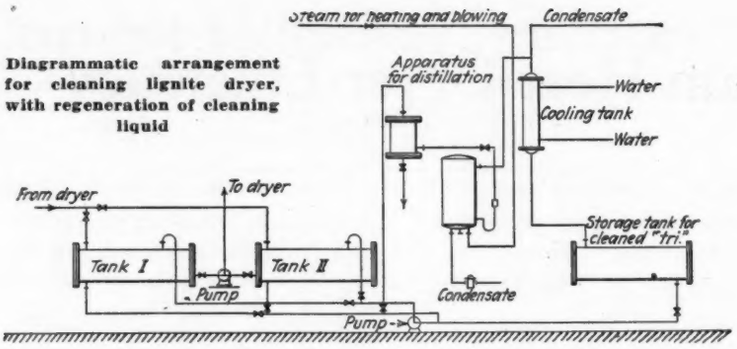
After cleaning, the performance of the dryer was again determined. The results obtained are given in Table I, presenting the average performance of four dryers. A distinct increase in efficiency and performance is noticeable. Capacity was increased 7.3 per cent, steam consumption was slightly lower, thermal effect better, and drying more intensive.

The cost of cleaning was low, because the greater part of the solvent can be re-used. From an original amount of 8,750 liters of "tri," 6,020 liters was recovered by distillation. Distribution of cost was as follows: Labor, 8.059 marks ($2,000); materials, 2,789 marks ($700); miscellaneous, 3,557 marks ($900); total 14,405 marks ($3.600). In comparing cost and performance, the fact must be considered that before it is marketed the greater part of the dried lignite is made into briquets of high thermal value. Calculation of profits must therefore be based on the selling price of this product.

The increase in performance was 7.3 per cent, or 24 tons of lignite per day for all four dryers. Basing calculations on briquets, this figure is 22.75 tons per day. Applying a factor of safety to take care of changes in feed, delays in operation, and other unforeseen conditions, a figure of 18 tons per day is assumed. Increased profits from better thermal

Table I—Dryer Performances

	Before Cleaning	After Cleaning
Lignite dried per 24 hours, tons	80	85.8
Water evaporated, tons per hour	3.1	3.5
Steam consumed, tons per hour	4.9	4.8
Steam consumed per ton of dried lignite, tons	1.5	1.3
Steam consumed per ton of water evaporated, tons	1.6	1.4
Kilogram-calories per kilogram of water evaporated	816	730
Moisture content of raw lignite (feed)	57.4	57.5
Moisture content of dried lignite (product), per cent	16.9	15.2



Diagrammatic arrangement for cleaning lignite dryer, with regeneration of cleaning liquid

effect, lower steam consumption, and higher drying ratio have not been taken into account in the following calculation, which is based on increase in tonnage only.

Cost per ton of briquets is 7.50 marks ($1.90), and the selling price 13.50 marks ($3.40). An increase in production of 5,400 tons per year corresponds to an extra profit of 32,400 marks ($8,100). Using an ample factor of safety, the assumption may be made that the dryers will not have to be cleaned for another five years. Amortization and interest must therefore be distributed over this period. With 7 per cent interest and 20 per cent amortization charges, the yearly amount for capital service is 3,897 marks ($975), leaving a net profit of 28,503 marks ($7,125).

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Granby-Type Mine Car

A. H. Hubbell

Associate Editor

QUESTIONS have been raised regarding details of construction of the Granby-type mine car since the article discussing that type appeared in a recent issue of this publication. The first of these is whether or not difficulty is experienced in keeping the bearing in the dumping wheel or roller. Of the three Granby cars discussed in the article referred to, the Mt. Hope car has no roller bearing but has a brass bushing. The dumping wheel is well lubricated from a grease cup and is said to give no trouble. On the other hand, considerable difficulty is reported to have been experienced with the dump wheel of the Consolidated Mining & Smelting Company's car when brass bushings were used.

Since substituting a Hyatt roller bearing, the company has had no difficulty in pulling the cars over the dump, nor any trouble with the bearing when it is properly greased. As for the car used by Granby Consolidated, the dump-wheel bearings are said not to wear rapidly as at present constructed. The long, large surface bearing now in use has been developed, over a period of years, to overcome the trouble referred to in the questions.

In the company's large 130-cu.ft. cars the center of gravity of the load is well back of the hinge, about 40 per cent of the live load being on one side and 60 per cent on the other, with the result that the pressure on the dump wheel and its bearings when dumping is considerable—a large bearing thus being necessary. On renewals, a bronze bushing 2-in. long is put at each end of the dump-roller spindle, instead of the full-length cast-iron bushing used in the original cars. This gives a large grease reservoir between the bushings, the arrangement lasting as well as the full-length bushing, in which, owing to the nature of the load, the wear comes at the ends of the spindle. If the dump wheel does not roll easily, it gets flat spots at once and is then a source of trouble, although it can be turned down.

Another question deals with the possibility of the car's tipping over into the grizzly on dumping. At Mt. Hope, precaution is taken against this by having a long 12x12-in. timber alongside of the car when dumping. At the Sullivan mine of the Consolidated company, three rails are bolted together across the bin, so that if a truck should leave the track when dumping, the car will not fall in. Such tipping is likely to occur, the company says, only when a piece of rock is so large that it will not pass through the door. On the large cars of the Granby Consolidated, a "hold-down" roller is thought necessary, although it was not used on the smaller cars at Phoenix. In the latter case, the weight in proportion to the overbalance was sufficient to keep the trucks down. That the rollers are subject to considerable thrust is shown by the number of renewals required.

A third question bears on the amount of additional tractive effort required to pull the car over the dump. At Mt. Hope, the management states, the only car to require more tractive pull is the first, after which the rest of the cars go over by themselves, so to speak. However, at the Consolidated's offices it is estimated that 50 per cent additional tractive effort is required.

At Granby's property, the tractive effort required for dumping has never been measured quantitatively. The slope of the block is important, the management states, but the velocity of approach is the limiting factor. The momentum of the train is depended on largely to assist in getting the cars over the block. Inasmuch as "hitting the block" resulted in jarring the car, an experiment was made to determine the right number of cars to be used with the different locomotives. Although a locomotive may be able to handle eight or nine cars on the track, it may not handle more than five or six over the dump block without excessive jerking and wracking. A locomotive can pull more cars over the block than it can push over, and on this account the cars are pulled out of, and pushed into, the mine, thereby cutting down the number of cars to the train. Different ways have been suggested for overcoming this drawback, but other considerations have made it unnecessary to handle long trains. The locomotive could be switched from end to end if necessary, says N. E. Nelson, the company's engineer; or a hoist with a cable could be so placed as to give the desired extra pull; or the grade of track might be made such that gravity would assist but not be so great as to prevent the locomotive from pulling the empties back over the block. This second dumping is helpful in keeping the cars clean.

The final question is as to where the hinge point should be placed. This, according to Mr. Nelson, depends almost entirely on the design of the car. The hinge could, conceivably, be located any place with respect to the wheel. Obviously, if it is too far from the center of gravity of the truck, more attention must be given to holding down the truck while dumping. In general, one may conclude that the hinge should fall between the wheels if a symmetrical car and nearly balanced loading be desired.

A. B. Ritchie, assistant manager of mines of the Consolidated company, says that the position of the hinges on that company's cars is on the outside edge of the stringer in line with the inside flange of the wheel. A wheel of 4-in. tread is used, and the outside support rail has had to be moved around the body of the car, so that when the car is dumped it will not rest on the top of the wheel tread.

The article referred to appeared in the October, 1930, issue. Attention is directed to the fact that the captions of two of the cuts (in that article) illustrating the 130-cu.ft. Granby car used by the Consolidated Mining & Smelting Company of Canada state erroneously that the car is in service at the Phoenix mines. The latter have been closed for over ten years. A Granby-type car was indeed formerly used in them. The 130-cu.ft. car illustrated, however, is in service today at the Consolidated company's Anyox and Allenby properties.

Mining Practice at the Sub Nigel

Owen Letcher

THE steady and notable improvement in efficiency at the Sub Nigel gold mine is one of the outstanding features of operations on the Witwatersrand gold fields at this time. When presiding at the last annual meeting of the company, held in Johannesburg in November, 1930, Mr. Douglas Christopherson referred with satisfaction to the excellent efficiency underground, as disclosed by the high figure of 6.77 fathoms mined per machine shift. This remarkably good achievement has recently been exceeded. The latest figure available is 8 fathoms per machine shift. Other recent statistics which reflect the high degree of underground efficiency obtaining at the Sub Nigel are: footage drilled per machine per shift, 223; footage drilled per fathom, 27.

Reduction in working expenditure and rise in profits secured during recent months have been the outcome of the continual and close application of the management to the various problems of the mine and to whole-hearted adoption, after a fair trial, of any new methods or devices that would tend to augment efficiency. The Sub Nigel, for instance, was the first mine on the Rand to apply narrow stoping on an extensive scale. In connection with the adoption of this system, various appliances and devices were developed. Recently, however, it has been found advisable to modify somewhat the ideas and methods that prevailed in the past regarding the limit to which narrow stopes can be most beneficially carried. Today, for example, the management is not breaking ore in a stope of less than 24-in. width.

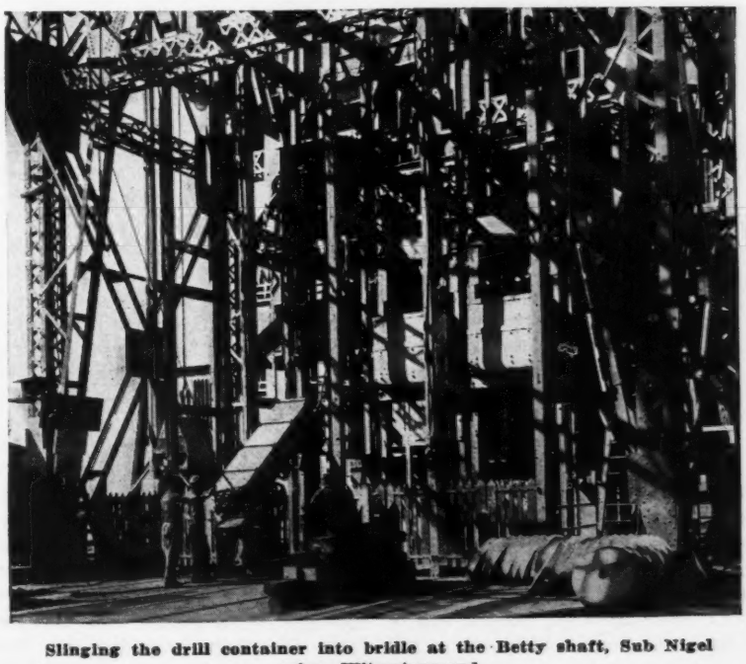
Also, some time ago, experiments were carried out with trays, in removing ore from the stopes. This method, after careful and lengthy trial, was found to be unsatisfactory and was abandoned. Although various devices and ideas which were experimented with have been found to be unsuitable, other methods and appliances have proved to be singularly adapted to the conditions obtaining in this mine, and in such instances a policy of whole-hearted adoption of the methods and devices in question has been adopted.

A most interesting and important departure from previous underground practice has been the adoption, during the last six months, of scrapers in stopes. Until the latter part of last year mechanical lashing was not in vogue at the Sub Nigel, and, prior to the employment of the first scraper much skepticism prevailed as to whether they would prove economical and effective in the narrow stopes. All doubts on this point were, however, soon removed.

Scrapers are now employed at several working places, and this system of removing broken ore is being extended. It has already been responsible for a notable increase in efficiency and reduction in working costs, and further improvements can be expected. About a dozen scrapers are now employed, and one-half of the tonnage sent to the mill is moved with them. They are employed in stopes where ore is broken over a large area as well as in working places where the ore is of restricted lateral width. In stopes of this latter nature, they are most effectively employed.

In addition to the increased use of scrapers, adoption of methods and devices for the economical and effective rejection of waste rock below surface, and the employment of fast-drilling jackhammer machines in stopes that are carried at the most economical width, various other methods and ideas developed to improve efficiency have been applied during the last year or two. For example, concrete disks, manufactured by the Hume Pipe Company, are now employed extensively for the support of the hanging wall, and, as in other mines, have proved to possess important advantages, as compared with older types of support, such as waste packs and pigsties. Transportation and distribution of steel underground has been improved, substantial savings having been effected by the use of a receptacle or container for transporting the steels, and by the employment of "drill houses" underground for the storing of drills. The drill container is a large metal box on wheels, into which steels from the blacksmith's shop are loaded. After it is loaded, the container is then slung in the bridle of the skip. On its arrival at the underground station, it is run out onto the haulage tracks and transported to the working places where the drills are required. Blunt steels are similarly returned in the containers to the blacksmith's shop from stopes and development workings. This method of transport and distribution of drill steels is rapid and economical.

At the Sub Nigel, skips, cages, and drill containers are slung into a bridle in the shaft that holds these receptacles. The change-over from either skip, cage, or drill container, one to the other, is carried out in four minutes, whereas, in the past, when skips and cages with bridles attached were employed, the change-over required twenty minutes. The property is no longer regarded as



Slinging the drill container into bridle at the Betty shaft, Sub Nigel mine, Witwatersrand

a comparatively unimportant side-show of the Rand, but is now rightly looked upon as a most vital annexure to the Far East Rand. In view of the remarkable developments at the Daggafontein and East Geduld properties, which foreshadow an important extension of the active mining operations east and southeast of what have hitherto been regarded as the confines of the Far East Rand gold basin, the Sub Nigel may perhaps be most correctly described as the outpost mine of the Far South East Rand. Before many years have elapsed a continuous chain of producing mines will probably link up the Sub Nigel with Daggafontein and the other properties of the Far East Rand basin.

Several features of the Sub Nigel stamp it as a mine very different from the average run of properties on the Central or Far East Rand. The orebody, for instance, is one single narrow reef that lies on shale, has a sandstone hanging wall, and dips at a comparative flat angle of 11 deg. This reef has always had the reputation of being a rich but erratic gold carrier, with less consistency of value than is found in the beds of the Central West and Far Eastern Rand. In spite of this eccentricity, the Nigel orebody is capable of yielding substantial profits, as has been proved by the long record of dividend distributions of the old Nigel mine, and by the fact that the Sub Nigel has, for a considerable number of years, yielded a materially larger profit per ton than has any other mine operating the conglomerate beds of the Witwatersrand system.

For many years, however, the Sub Nigel was content to plod along as a small outlying and detached gold mine, operating on a slender basis of crushing, and earning moderate profits on a modest capital. The original company was registered in 1895, later absorbing the old Nigel Deep mine, which commenced crushing in 1899 and resumed productive operations after the Anglo-Boer War in 1905. Amalgamation of the properties took place in the 1909-10 period under the title of the Sub Nigel G. M. Company. A 30-stamp battery which crushed about 4,000 tons per month was operated. Expenditure practically balanced revenue at between 30 and 40s. per ton. The results and prospects of the company gradually improved, but not until 1926 did the Sub Nigel come into prominence as a potential earner of large profits. In that year the company's earnings advanced markedly, development operations disclosed substantially better results, and negotiations were successfully concluded with the government for the acquisition of a large additional area.

Explanation should be made that additional properties have been acquired by the company from time to time, including a lease from the government of the Union of South Africa of 2,530 claims on the farms Grootfontein No. 152 and Varkensfontein No. 217, immediately adjoining the southern boundary of the Sub Nigel property. The consideration payable to the Union government was 2½ per cent of the annual profits for the first four years, calculated as from May 21, 1926. This period having expired, the government is now entitled to a share calculated according to the formula: $y = 15 - \frac{150}{x}$ where x is the ratio of net profits to recovery expressed as a percentage, and y is the percentage of profits payable to the government. This share is in addition to any taxation now imposed on the profits of mining, with the exception that should such taxation be increased, the amount payable as the government's share of the profits will be reduced proportionately.

The Sub Nigel property of today, including the leasehold area acquired from the government, is a large one, embracing 4,555½ claims and the freehold of the farm Bultfontein. Throughout the company's mining area, the reef, as exposed to date by development operations, is a relativel ythin orebody; that is, in comparison with the width of the orebody on the Far East Central and West Rand. The average gold content is, however, appreciably higher, and in the well-defined pay shoots the value is substantially higher than in other sections of the Rand.

Formerly, when the property was operated on a small crushing basis, development restricted to a few hundred feet per month, and ore reserves, in consequence, were small, large fluctuations in the monthly grade were unavoidable. Today, with a much more active development policy, with an ore reserve amounting to more than 1,000,000 tons, and with a better understanding of the lie of the pay shoots, fluctuations in recovery over monthly periods can be and are avoided. Although the basis of crushing at the Sub Nigel has been increased materially during the last few years, the mine is still a small-tonnage property.

The crushing and treatment plant, situated in the vicinity of "C" shaft, is fed by two main haulageways. No. 1 shaft is situated east of the plant, and the new Betty shaft, which was commenced in 1927 and completed in 1929, is about two miles north of No. 1 shaft. Ore from these shafts is transported to the mill by small locomotives. The existing plant consists of 40 stamps and seven tube mills. An additional tube mill is being installed, together with thickening and agitation equipment. These new units will be placed in operation this month, increasing the capacity of the plant to 33,000 tons per month. Even on this augmented basis, the Sub Nigel will still be a small-tonnage undertaking, in comparison with the huge crushing installations which are the order of the day on the Rand. Actually, only one mine along the reef deals with a lesser tonnage—namely the Meyer and Charlton property.

The Sub Nigel, on account of its relatively small-scale operations, the scattered nature of its workings, the thin character of the roof and large expenditures for claim licenses, has a materially higher rate of working expenditure than any other property on the Rand. The present operating program specifies 5,000 ft. of development per month—a footage exceeding that of the majority of the producing mines of the Far East Rand proper, as well as that of most of the mines of the Central and West Rand. But, although the Sub Nigel is operated on such a small basis of crushing and has the highest costs per ton on the reef, the mine is the seventh largest profit earner of all the gold mines of the Transvaal, its present earnings of £60,000 per month being exceeded only by those of Crown Mines, Government Areas, Modder Deep, New Modder, New State Areas, and Springs Mines.

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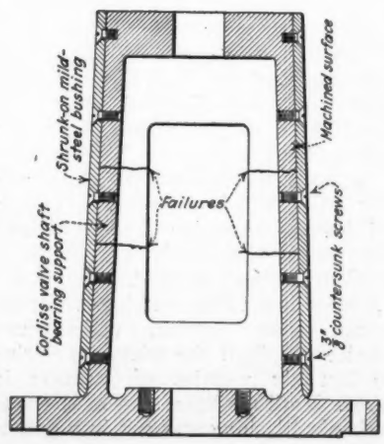
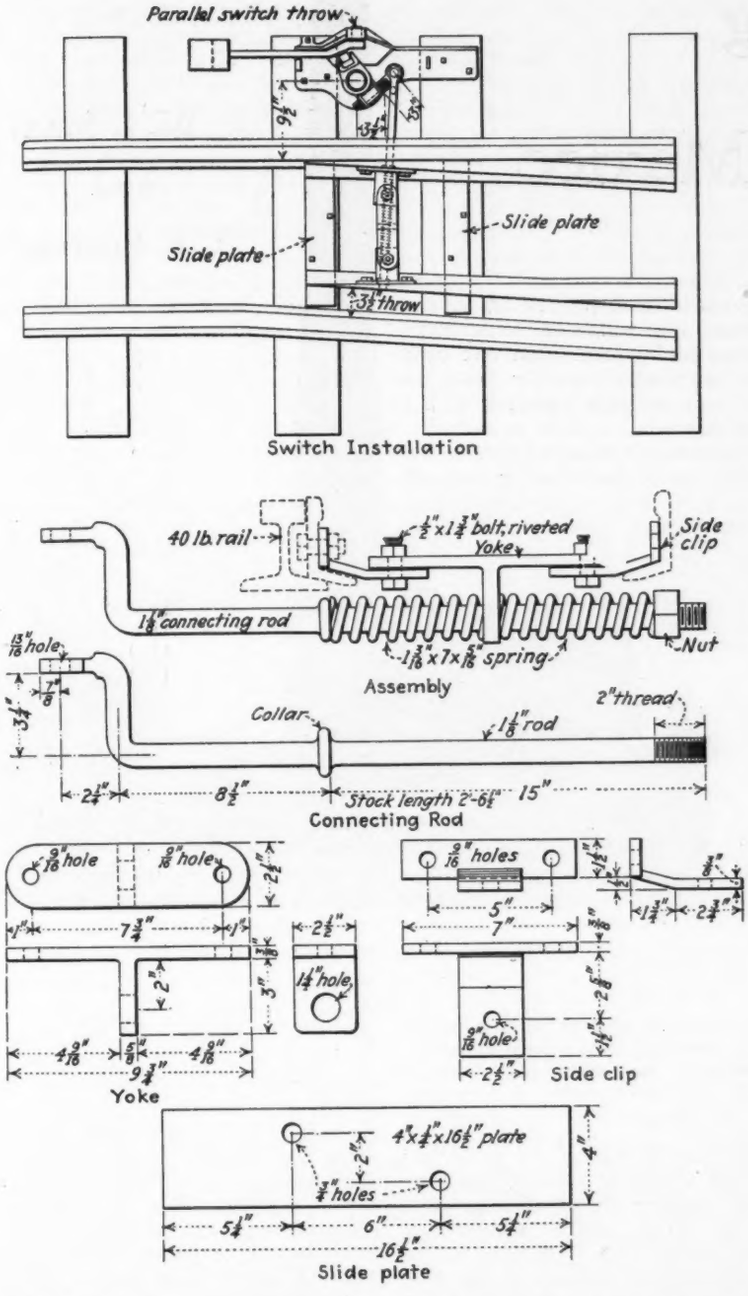
Repairing Bearing Support of Corliss Valve Shaft

AT THE power house of the Compagnie Du Boleo, Santa Rosalia, Baja California, Mexico, one of the valve shaft bearing supports on the 500-hp. steam-driven blowing engine that supplies air for the converters suddenly broke and had to be taken out of service immediately. In urgent need of the machine, and with no spare available, A. Jannison, master mechanic, repaired the broken support by preparing a welded and forged mild-steel bushing, with a carefully machined press-fit bore, as shown in the accompanying sketch. The bushing was shrunk on to the support body, and, to lend additional stability, ⅜-in. countersunk screws were placed at the points indicated in the illustration.



A Compact Switch Throw



FOLLOWING the general policy of the United Verde Copper Company in making improvements to equipment that will tend to lower operating costs and increase efficiency, the subject of underground track and switches has received a great deal of attention, writes F. M. Keesling.

Standard track is 18-in. gage, 40-lb. rail laid to grade and well ballasted. Wood ties, treated and untreated, are used. Steel ties have not been used, because of the corrosive action of the mine water.

Split switches are used in all haulage drifts, although a three-way stub switch is used at the stations. A number of types of switch throws have been used with the split switch, but a ground-lever type, with yoke and springs, has become practically standard. When the crosscuts to No. 7 Shaft were started, the large number of switch installations brought up again the problem of throws, and a paralell-throw model No. 1217, with a very short connecting rod, has been adopted as standard.

The disadvantages of the ground-lever type were weight, number of disconnected parts, special long ties to support the lever, and principally the necessity of cutting ground at the side of the drift to make room for the lever and its operation. The last item was the chief reason for adopting a new type.

The parallel throw model No 1217 is a standard type with the track equipment manufacturers, and is light and easily operated. Catalogs were consulted in an effort to find a standard connecting rod that would allow the throw to be placed near the track, thus avoiding the cutting of additional ground. All of the attachments found were so long that their use would not permit placing the throw near the track, the only exception being an attachment for placing the throw between the rails, which is not possible with a model No. 1217 throw and an 18-in. gage track.

The connecting rod shown in the accompanying sketch is light and compact, and allows the throw to be placed on a standard tie near the track. Springs have been incorporated that automatically take up any inaccuracies in setting the throw. The connecting rod, springs, yoke, and side-jaw clips are assembled in the shop, forming one unit, so that complete installation consists of only two units: the switch throw and the connecting rod units. When making an installation, the underground trackman has only to bolt the connecting rod unit to the switch points, and spike the throw to the ties at its proper position. If the connecting rod unit is damaged, a new unit is bolted in place of the damaged unit, which is sent to the shop for repairs. Repairs can be made easier and cheaper in the shop, where facilities for the work are available.

This switch throw combination has given excellent service, and the operating force at the United Verde believes that is is an ideal unit for use on narrow-gage mine tracks where space is always limited.

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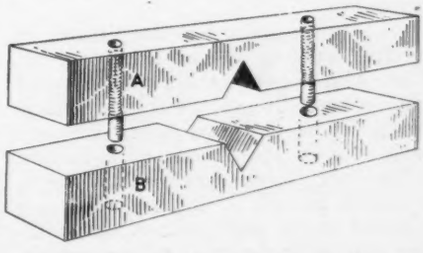
Supplementary Jaws for Vise

TO LEND additional flexibility to the standard bench vise, expedite and ease the threading of bolts, and make possible holding and taking apart machine parts containing extra-short pipe nipples or studs, Thomas C. Hulton, master mechanic, Cia. Minera Chambas, Abras Grandes, Cuba, designed the simple and efficient supplementary jaws illustrated in the accompanying sketch. Each jaw is made of 1⅛x1⅛x3½-in. tool steel, and, to keep them in perfect alignment constantly, jaw *A* is fitted with two short guide pins made of ⅜-in. rod



that rest in the ⅜-in. holes of jaw *B*. This inexpensive device, requiring no machine work, is a valuable addition to the machine-shop tools and is in almost daily use.

Zinc Smelting in Mexico

W. J. Jenni
and
R. F. Spooner

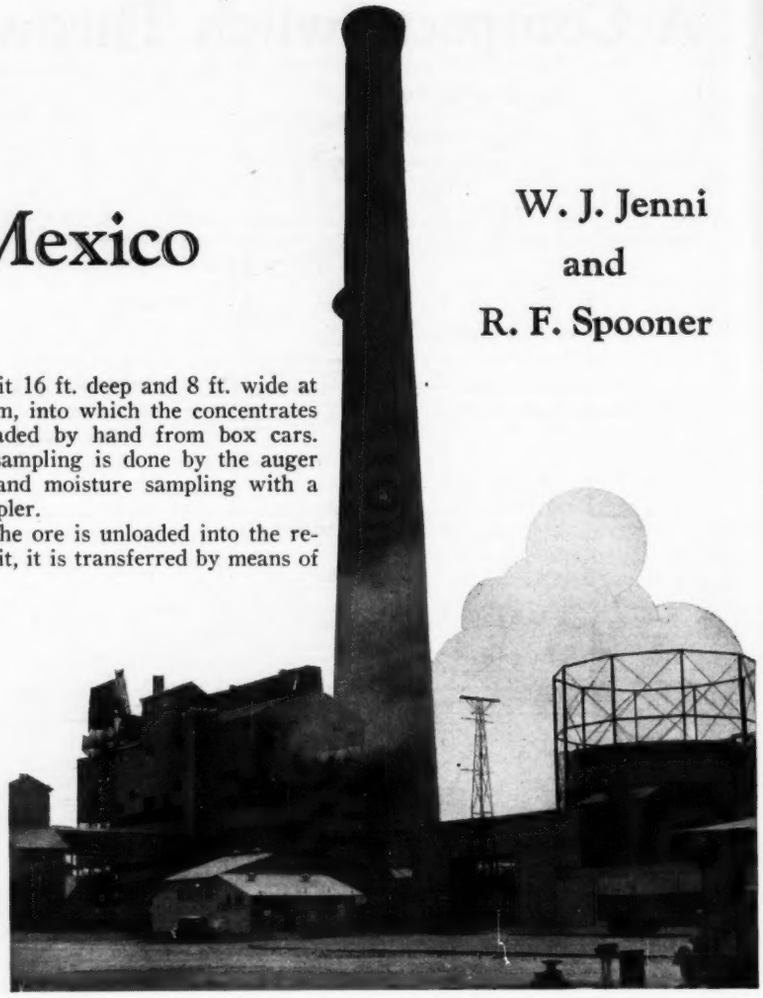
THE one zinc smelter in Mexico is at Rosita, Coahuila, 75 miles from the American border, at Eagle Pass, Tex., and about 235 miles from San Antonio, Tex., on the line of the National Railways of Mexico. This site was selected because of its proximity to the only commercial coal deposit in Mexico. The plant is operated by the Mexican Zinc Company, S.A., and adjoins the plant and coal mines of the Compañia Carbonifera de Sabinas, S.A. Both companies are subsidiaries of the American Smelting & Refining Company.

Concentrates from the American Smelting & Refining Company's mines in Mexico comprise principally the material treated, although some custom concentrates are used when plant capacity is available. An ample supply of good water is usually to be had, owing to the fact that the plant is situated in the valley of the Sabinas River. The elevation is about 1,200 ft. above sea level. Coke is used as reduction fuel and for sintering. Coal is employed at the gas producers and other points about the plant. A limited amount of byproduct coke-oven gas is available.

POWER is generated in the plant of the coal company, and transmitted to the zinc plant as generated at 6,600 volts. Steam for gas producers, pottery, and other units is also furnished by the coal company, at 150-lb. pressure, through a 6-in. overhead insulated pipe line, 2,200 ft. long. The major shop facilities for both plants, as well as the warehouse, are situated near the coal plant. The timekeeping force at the main gate is common to both plants. All switching is done by the equipment owned and operated by the coal company.

The ore-receiving bins are situated in a steel building housed in corrugated iron, with the entire bin area covered and served by an overhead electric bridge crane of 7½-ton lifting capacity and a 94-ft. span, with a 55-ft. lift. This crane is equipped with a 2-cu.yd. clamshell bucket. Unloading tracks are situated at the north side of the building, one under the roof and one outside. Between the two loading tracks is a receiving pit 16 ft. deep and 8 ft. wide at the bottom, into which the concentrates are unloaded by hand from box cars. Control sampling is done by the auger method, and moisture sampling with a pipe sampler.

After the ore is unloaded into the receiving pit, it is transferred by means of a grab bucket to one of the dump pits under the craneway, which have an average capacity of 1,000 tons each. Total ore storage capacity under cover is about 12,000 tons. Mixing of the ore from different shippers is not done in the storage dumps, each dump being confined to one shipper's product. The ore is lotted by the shipper, and is received in ten-car lots. Settlements are made on this lot basis.



451-ft. roaster stack of the Mexican Zinc Company, with roaster department to the left and gas holder to the right

RECLAIMING is accomplished by means of the grab bucket and the traveling crane. The various ingredients of the concentrate mixture are discharged into three steel hoppers situated in the center of the bin structure. Below these bins and immediately above a 24-in. conveyor are individual feeder belts. Material from all three of these hoppers is fed onto the conveyor belt in the proportions desired. The mixture travels on the belt to a feed hopper, and enters a Ruggles-Coles Type B-14 dryer, 90 in. in diameter by 50 ft. long, with a capacity of 24½ tons per hour of material varying from 12 to 5 per cent moisture. The dryer is fired by means of slack coal on a grate, and the moisture content is reduced from about 7½ per cent as fed, to 2½ per cent as discharged from the dryer, at which point the moisture is sufficient to prevent dusting. The discharge from the dryer passes by means of a steel screw conveyor and elevator over a 4x5-ft. V-16 Hum-mer screen, with a No. 390 Ton-cap screen cloth, and openings of 0.19 in. From the screen, the oversize passes by gravity to a set of 20x24-in. Jeffrey rolls, which operate in closed circuit with the screen. Undersize from the screen passes over a drag belt to the roaster building, where it is elevated and distributed to the various roaster feed hoppers by means of reversible belt drag conveyor. All motors in this system from the feeders to the receiving hoppers are electrically interlocked, so that, should an interruption occur at any point, the entire system would be shut down until the trouble was corrected.

THE plant is equipped with four 20-ft., twelve-hearth Skinner roasters, manufactured by the Colorado Iron Works, of Denver. These roasters are driven by individual motor drives,

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with speed reducers and suitable shear-pin couplings. Center column and arm cooling air can be applied to the various hearths, where needed. Extraneous heat is furnished by coke-oven gas, when available, supplemented by slack coal, fired on grates. The coal is burned for the bottom hearth, the oven-gas heat being applied as needed above this point. The feeding mechanism is of the pan conveyor type. Ore fed to the roaster contains about 33 per cent sulphur, and emerges as pre-roast, ranging from 5 to 9 per cent sulphur.

Each hearth is equipped with a thermocouple, with extension leads to a recording panel in the foreman's office. Careful observation of temperature is adhered to in controlling the roast. The roasters treat an average of 60 to 90 tons per day each, according to plant requirements. Gases from the roaster, laden with flue dust and fume, pass through cast-iron outlet pipes from the furnaces directly into an unlined steel balloon flue, then through a flue to a modern four-unit, three-section, plate-type Cottrell treater, and thence to a stack, the top of which is 451 ft. above the ground level and 25 ft. in diameter. The gases enter through a breaching at the ground level. Balloon flue dust and fume are returned to the roaster feed. The finished roast passes out of the bottom hearth of the furnaces and onto a push-type cooling conveyor, running longitudinally from one end of the building to the other. All furnaces feed onto this conveyor, which discharges at right angles onto a pan conveyor, which, in turn, discharges to the feed hopper of a Traylor cooler, consisting of eight water-cooled tubes, 20 in. in diameter and 35 ft. long, mounted on a horizontal axis and rotating 2½ times per minute under a spray of water. This device has a rated capacity of 15 tons per hour, and cools the material practically to atmospheric temperature. After leaving the cooler, the material is elevated to a vibrating screen identical with that already described. Oversize lumps pass through a set of 14x36-in. Traylor rolls, in closed circuit with the screen. Undersize from the screen passes by gravity into either of the two 400-ton steel storage tanks.

AT THE sinter machine the charge is made up of about 80 per cent pre-roast, about 15 per cent of return crushed sinter (made up principally of rejected material from the discharge end of the machine and windbox cleanings), and the necessary proportion of crushed coke. Feed to the machine varies from 5 to 9 per cent sulphur and from 2½ to 5 per cent coke, as conditions require. Material from the storage tanks passes to a horizontal belt conveyor, which also passes under similar coke and diluent bins, each provided with a belt conveyor feeding mechanism, variably speed driven. The mixture is proportioned by the size of the opening and speed, and discharges at the end of the accumulating conveyor to an elevator, which, in turn, discharges to a Stehi rotating mixer, where moisture is added in sufficient quantity to give proper porosity of bed for efficient operation of the sintering machine.

Particular care is exercised in passing the material from the mixer to the pallets to avoid formation of crusts, segregation of lumps, and to provide uniform porosity across the entire width of the pallet. The sinter machine is of the Dwight & Lloyd type, designed by the engineering department of the American Smelting & Refining Company. Its general dimensions are: pallet width, 63 in.; length of windbox, 60 ft. Suction is provided by a Sintering Machine Corporation fan of 75,000 cu.ft. per minute capacity, at a maximum vacuum of 15 in. of water, directly connected to a 300-hp. 6,600-volt synchronous General Electric motor. Machine speed is controlled through suitable speed reducers, and the motor provides a variable speed range from 400 to 1,600 r.p.m., resulting in variation in pallet speed from 27 to 106 inches per minute. Ignition is provided by a coke-oven gas-fired muffle. The average depth of bed is about 8 in.

FINISHED sinter discharges from the pallets at the tail end of the machine directly into a set of 24x48 in. Allis-Chalmers steel corrugated rolls, driven by a 75-hp. motor. Undersize from the rolls is elevated, passed to two vibrating screens, one of which is provided with wire cloth of 1-in. mesh, and the other with Ton-cap No. 390 0.19-in. cloth. Undersize from this screen is finished product. Oversize from the large screen returns to the corrugated rolls. Undersize from the large screen and oversize of the second one passes to a set of auxiliary Jeffrey 24x30-in. smooth-faced crushing rolls, belt driven, that operate in closed circuit with the screens. The final screened sinter is elevated and discharged into a 300-ton finished-sinter storage tank, immediately above a shuttle car track, from which the sinter is drawn intermittently into a 25-ton shuttle car, operated by a cable tramway. This transports the sinter from the Dwight & Lloyd plant to the mix-room storage tanks through a series of complementary conveyors and elevators.

The gases discharged by the Dwight & Lloyd fan pass into a brick flue, 250 ft. in length, through a No. 12 Sirocco fan of 100,000 cu.ft. rated capacity at 146 r.p.m., driven by a 125-hp. constant-speed motor; then into a brick baghouse, equipped with seven sections, each composed of 122 bags, 18 in. in diameter and 30 ft. long. Filtered gases pass through a brick flue entering the stack, where they join the gases from the Skinner roasting plant. Dust accumulated at the baghouse contains sufficient metal content, and is low enough in zinc, to permit its shipment directly to a lead smelter. The dust is handled from the pits to the cars by a pneumatic handling system developed at the plant.

NUT COKE AND BREEZE used for fuel are received from the coal company in dump-bottom cars, and discharged by means of a suitable conveyor into a 12x20-in. Blake crusher, passing thence to V-16 Hum-mer screens, with screen cloth of 1-in. mesh. Oversize is fed to a set of 14x42-in. United Iron Works rolls, operating in closed circuit with the screen. Undersize, by suitable conveyors, is fed to a Hardinge 5x10-ft. rod mill, and is discharged from the rod mill at a fineness of about minus 8 mesh. The plant has a crushing capacity of 125 to 150 tons per day.

Crushed coke is delivered to storage tanks over the mix-room track, at the opposite end of which are the crushed-sinter storage tanks. Crushed sinter is drawn through gates in the bottom of the tanks into hand tram cars of one-ton capacity, and trammed over scales to the mixing hopper, where coke, trammed in similar cars after weighing, is dumped with the sinter. Salt, to the extent of about 10 lb. per batch, is added to the mix. A Ransome concrete mixer of 80-cu.ft. capacity is used for mixing the charge, which is slightly moistened before mixing. The prepared charge is elevated and passed through a pug mill, where sufficient water is added so that the discharged material contains about 10 per cent moisture. From the mill, the pugged charge falls into tram cars that hold four batches each. The cars are trammed by hand to the retort blocks.

PLASTIC CLAYS used in the manufacture of the retorts and condensers are secured from the St. Louis district and Europe. Flint clay for retort grog comes from Colorado, and grog for condensers is obtained locally. Condensers are made of a mix composed of 65 per cent grog by weight, ground to pass a 4-mesh screen, and 35 per cent plastic clay, ground to pass a 10-mesh screen. Grog and plastic clay are mixed in a 2x6-ft. United Iron Works pug mill, with the water necessary for the desired plasticity, and then allowed to rot overnight. A second pugging is made before the mud is delivered to the Whipple condenser machine.

After drying the condensers several days, they are burned. Two types of kilns are used: small, rectangular down-draft coal-fired kilns, with a capacity of about 1,200 condensers each, of which there are three; and one 25-ft. diameter beehive-type kiln that will hold about 7,000 condensers. Condensers are burned in both types of kilns to a temperature of about 1,200 deg. C.

CYLINDRICAL RETORTS 8¼ in. inside diameter by 60 in. inside length are used. A part of the plant is operated with silicon-carbide retorts, and the remainder with clay retorts. Practice in the manufacture of clay retorts is

similar to that used in zinc plants generally. In the manufacture of carbide retorts, particular care is taken to mix thoroughly in a pan mill 35 per cent plastic clay by weight with 65 per cent first-quality silicon carbide. The pan-mill discharge is alternately twice pugged and rotted at least one week before being taken to the retort press.

Retorts are manufactured in a Wettengel retort press of modern design, and are trammed by hand to steam-heated drying rooms, where the clay retorts are allowed about 90 days' drying before being put in the pre-heating kilns at the retort blocks. The carbide retorts are handled in a similar manner, except that a longer drying period is allowed, if possible.

The plant is composed of eight blocks of retort furnaces, varying in size from 768 to 832 retorts. These blocks are fired in a number of different ways. Two of the blocks are fired with by-product coke-oven gas, obtained from the coal company. Six blocks are fired with gas producers. Five of these six producers are of the R. D. Wood heavy-duty type, 10 ft. 6 in. in diameter. The sixth producer is the latest type of Morgan Construction Company producer, 10 ft. in diameter. The coke-oven gas-fired blocks are similar in practically every respect to the common design used in the natural-gas fields in the Southwestern states. Producer-gas blocks are consolidated into about 400 retorts on each side. Gas producers are situated at one end and stacks at the other. The gas passes from the producer through a dust catcher, or cyclone collector, thence directly into combustion chamber and furnace laboratory. Admission of combustion air is similar to that in natural-gas practice. Regeneration of either gas or air is not employed, and no use is made of the waste heat emerging from the stacks.

CLAY RETORTS are used on the producer-gas-fired blocks and show an average life of 35 days. Carbide retorts are used on the coke-oven gas-fired blocks and average 175 days' life. Condenser life varies from five to six days. The tools used in working the furnace are essentially the same as those in general use in the United States.

Training of labor, which is entirely Mexican, has been necessary, inasmuch as, prior to the construction of the Rosita zinc plant, no commercial spelter had been produced in Mexico. Efficiency of labor to date is not on a par with that of the better sections of the United States zinc fields, though a steady improvement is noticeable.

Metal is drawn three times during the day. Residue is handled in the usual manner, through tunnels which are excavated by means of a dragline scraper to a shaker conveyor, and thence by elevator to gondolas or box cars for shipment to lead smelters. Incident to the loading of the residues, mechanical sampling apparatus is installed. Residues produced amount to about 40 per cent of the green weight of the concentrate.

METAL drawn from the furnaces is cast in a manner similar to that commonly practiced in the United States. The metal is trammed to the storage-weighing yard, where first and second draws are loaded for shipment as Prime Western metal, or stored. Third draw and any possible off-grade from the other draws are delivered to the refining department.

The refinery plant consists of two reverberatory-type liquating furnaces, of 6x24-ft. inside dimensions, with depth of bath of about 3½ ft. These furnaces are fired either with coal or byproduct gas. The refined metal is of Prime Western grade. Lead and iron-zinc are removed from the furnaces periodically. Spelter is shipped in box cars to the Gulf ports of Texas for reshipment to Europe, which is the destination of practically all the metal produced at the Rosita plant.

Part of the gases from the Skinner roasters are conveyed to a contact sulphuric acid plant, where cleaning is accomplished by settling flues, Cottrell, and washing towers. After cleaning and pre-heating, oxidation of the sulphur dioxide is accomplished by means of Grillo-type converters, using Monsanto contact mass. Normal acid, strength 98½ per cent, is the standard production of this plant, which has a capacity of about 25 tons per day. The plant is also equipped to produce part of this output as oleum.

Broken condensers are passed through a wet-milling plant, consisting of crushers, rolls, screens, jigs, and Wilfley tables. Tailing is sent to waste, concentrate being returned to the retort plant, where it is worked on a separate block.

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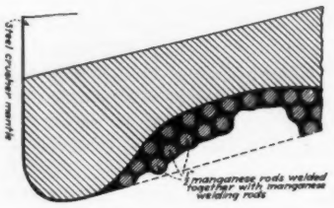
Welding Method Reduces Crusher Repair Costs



AN innovation at the crushing plant of the Moctezuma Copper Company, Nacozari, Sonora, Mexico, that has considerably decreased crusher repair costs, is a recently developed method of repairing the worn mantles of the No. 8 McCully crushers. For years the cavity worn into the mantle was built up by arc-welding, using manganese welding rods. The total cost for power, labor, and welding material was considerably below the price of a new mantle. Experiments, conducted in an effort to reduce costs further, resulted in the perfection and adoption of the procedure shown in the accompanying sketch. The departure from the former practice consists in the use of short manganese rods, curved to fit the circumference of the crusher mantle, which are welded carefully first to the worn mantle surface and then to each other until the original mantle surface is restored. The ½-in. manganese rods cost only 14c a pound, compared with 66c. a pound for manganese welding rods. Moreover, the procedure effects a 50 per cent reduction in time, power, and welding material.

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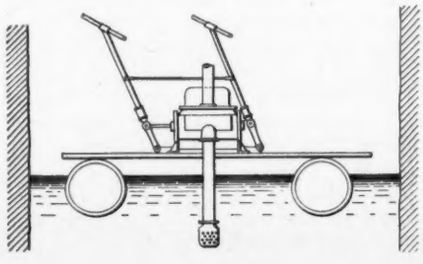
Unwatering a Prospect Hole

CONFRONTED with the task of unwatering an old prospect shaft, where no mechanical or electrical power was available, the problem was solved successfully, and at low cost, by the following method, devised by Thomas C. Hulton, master mechanic, Cia. Minera Chambas, Abras Grandes, Cuba. A two-man hand pump, equipped with a short suction pipe and an adjustable discharge pipe, was mounted on a small raft on two empty oil barrels, as shown in the accompanying sketch. The discharge pipe was lengthened periodically, according to the falling water level.



Cyaniding Low-Grade Gold Ore

Bulk leaching of ⅜-inch. crusher product, containing 0.4 per cent copper, proves the technical adequacy and economic efficiency of a process now in successful operation at the Mountain Copper Company's property in California

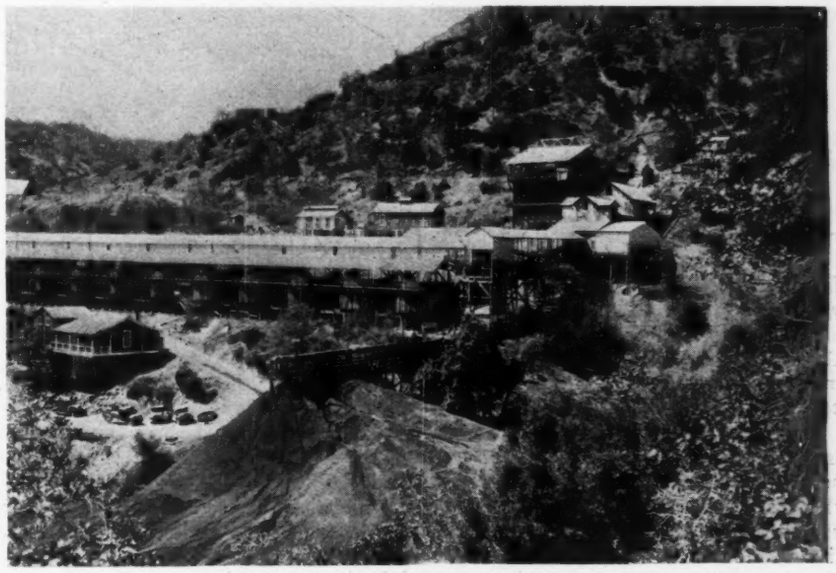
George J. Young
Associate Editor

DURING the last 35 years the Mountain Copper Company has operated steadily in Shasta County, Calif., at first producing copper from high-grade sulphide ore at Iron Mountain, and subsequently mining pyrite from the Hornet mine, which is shipped to chemical plants on San Francisco Bay. When copper prices were high, it worked low-grade siliceous ores. In addition, cement copper was and is recovered from the mine waters at Iron Mountain. After precipitation, the waters are pumped back and allowed to percolate through the worked-out portions of the mine. Consequently, the property produces copper at all times.

By careful management the company has coped successfully with adverse economic conditions for several years; but the uncertainties of the recent and existing copper market, coupled with a somewhat decreased demand for pyrite, made it desirable to investigate the possibilities of a large low-grade gold-bearing gossan deposit it owns. Steps were taken to sample and to measure the available tonnage. An experimental plant was operated and the metallurgical treatment of the material was developed.

The company investigated this deposit as early as 1909. Excessive consumption of cyanide discouraged attempts to proceed at the time, but hope was never abandoned that a way would eventually be found to recover the gold. In 1928, the Merrill Company, of San Francisco, reported that the material could be successfully treated and that cyanide consumption would not be high. As a result, a 4-ton testing plant was erected and seventeen tests were made. The ore treated averaged $2.40 per ton in gold. Extractions ranged from 75 to 87 per cent. Cyanide consumption averaged 0.3 lb. per ton. Lime required varied from 15 to 20 lb. per ton. The material proved to be readily leachable. On the basis of these tests a five-vat leaching unit was erected, subsequently increased to a ten-vat plant in 1930. This, now in regular operation, so far has treated successfully about 135,000 tons.

The gossan, above the old Iron Mountain sulphide orebody, now almost mined out, is of variable thickness and partly covered in place by overburden. Being porous and friable, it could not be sampled by diamond drill. However, the character and contents of the upper horizon of the copper ore were known, and the assays from the overlying gossan indicated an average of $1.60 per ton in gold. The approximate value of the lower horizon of the gossan was thus known. Its surface was divided into 50-ft. squares, each of which was sampled. The composite surface sample assayed $2.40 per ton gold. The total quantity was estimated at 365,000 tons, averaging about $2 per ton, and 190,000 tons averaging from $1.40 to $1.60 per ton in gold, or a general average of about $1.85.



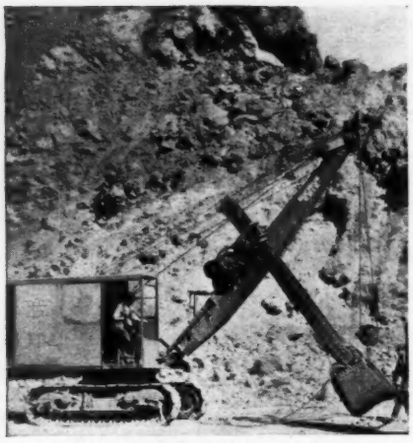
General view of cyanide leaching plant, with tailing dump in foreground

In the deposit mined, the gossan consists of limonite and quartz. Besides gold it contains about 0.4 per cent copper, a little arsenic, a small amount of mercury, from 50 to 55 per cent iron, and 5 to 10 per cent silica. The weight of the crushed material is 100 to 125 lb. per cubic foot — equal to an average settled weight of about 104 lb. per cubic foot.

The quarry was opened by mining directly into the side hill. In addition, a road was cut between the cyanide plant and the quarry entrance, 2,500 ft. long. A small power shovel was used in road and pit preparation and for initial mining. Subsequently, a Bucyrus-Erie electric shovel, caterpillar mounted, full revolving, with ¾-yd. bucket, was installed. All loading is now done with this. Three 3½-ton Mack trucks, used for transportation between pit and plant, handle over 8 tons per load, and move the 550 tons required in six hours, the remaining two hours being used in hauling overburden, which is dumped along the road edge, thereby increasing the road width. Each truck averages about four loads per hour, so that during the day shift the maximum number of trips may reach 72.

Initial mining is accomplished by gopher-holing, followed by a moderate amount of blockholing of large masses. Only a single level is now maintained, and bench heights toward the hill have reached about 75 ft. A 20 per cent low-freezing dynamite is used, about 4,000 lb. being required per month, indicating an explosive ratio of 0.25 lb. per ton of ore. The only use of rock drills is for blockholing.

The ore is dumped over a rail grizzly with 9-in. openings, of a width sufficient to allow three trucks to discharge at one time, the receiving section being inclined and the lower portion horizontal. The rails are separated by spacers, and ball-mill liners are bolted on top at intervals to hold them securely in place. The re-



Power-shovel unit used for digging and loading

ceiving bin, directly beneath, 38 ft. long by 16 ft. wide and 20 ft. high, will discharge a total of 350 tons. Its bottom is served by three horizontal rack-and-pinion gates delivering to chutes and thence to adjustable spouts. The feed is controlled by varying the discharge-spout angle and by adjusting the gate. These spouts discharge on a 42-in. pan conveyor, beneath the ore bin, driven at 6 ft. per minute by a 5-hp. motor and a speed reducer. It discharges onto a rail grizzly, 38-deg. slope, 2-in. spacing, the oversize going to a 10x20-in. Buchanan rock breaker. Undersize is bypassed to a conveyor that also receives the crusher product and delivers both to 40x15-in. rolls of the Anaconda type. A belt conveyor takes the roll product to a Link-Belt separator, equipped with Tyler Tyrod screen, the distance between wires being ½ in. This screen was selected because of its ability to cope with clayey material, which gave trouble during the winter months, when the ore contains an excess of moisture.

Screen oversize is discharged onto an incline conveyor, which delivers it to a set of 20x12-in. rolls discharging onto the conveyor feeding the vibrating screen, the undersize from which is delivered to the conveyor serving the leaching vats. All conveyor belts are 20 in. wide. Lime, received in 30-gal. oil drums, each holding 285 lb., is delivered by a wire-rope tramway from Matheson. A belt feeder delivers it to the conveyor serving the screen. The ore was originally crushed to 1 in., then to ½ in., and it is planned to crush to ⅜-in. size in the future. Crushing is done only when the vats are being charged. The ore is only slightly abrasive, so crusher plates and roll shells show little wear.

Motor equipment is as follows: 75-hp. motor for crusher, rolls, and conveyor to primary rolls; 5-hp. motor with speed reducer for screen conveyor; 15-hp. motor for oversize return conveyor and secondary rolls; 10-hp. motor and speed reducer for tripper conveyor serving vats; and 2-hp. motor for the screen. Total motor horsepower in crushing plant, 112.

A tripper conveyor operates above the vats. Crushed ore is discharged from the conveyor into the vats by a Jeffrey auto-tripper. By means of short lengths of trough it is spouted to position, and the formation of cones avoided. The vat is filled in layers 1½ ft. thick, the ore being moistened before charging to avoid segregation, except in winter when sufficient moisture is present. Two vats are charged and discharged each 24 hours, one by the day shift and the other by the night shift. Five vats are assigned to the day shift and five to the night shift. Vats require about seven hours to fill and three men discharge a vat in one shift. Each of the ten vats holds 276 tons. Vat dimensions are 25 ft. 8 in. inside diameter, by 12-ft. stave, giving an effective inside depth of 11 ft. Each vat has four discharge doors, 16 in. square. The filter bottom is of coco matting and 10-oz. canvas, with 2x2-in. shoveling cleats spaced 6 in. apart. To avoid excessive discharge when the doors are opened, a "choke plate" (Fig. 1) is provided, which reduces the discharge rate during the initial stage of emptying.

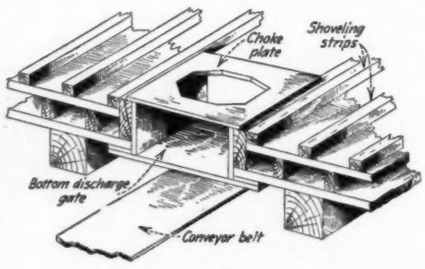


Fig. 1—Cross-section to show choke plate above discharge gate

Two conveyors, operated by a 20-hp. motor, receive the discharged residue and deliver to the tailing conveyor, at right angles, operated by a 5-hp. motor and delivering directly to the dump, from which the tailing is washed to a retaining dam. Filter bottoms are washed out once every six weeks. Weather protection is afforded by a roof extending over the tripper conveyor and part of the tank. On the exposed portion of the vat, canvas curtains are attached, by hooks, where required, to protect the workers who discharge the tailing. Four safety ropes are also provided.

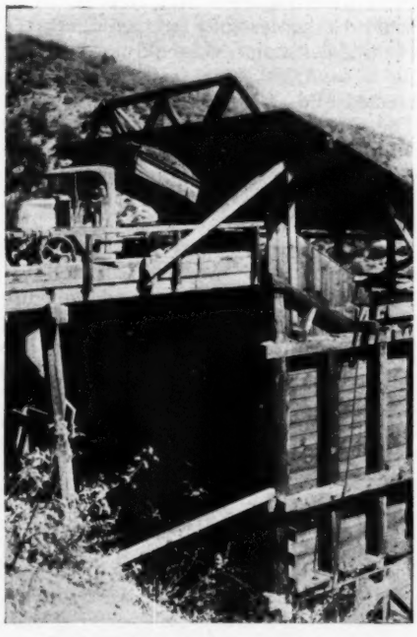
Filling is carried within 3 in. of the top, and 6 to 9 in. settlement occurs during solution treatment. Solution inflow is started from the bottom upward when the vat is half charged. Four solution lines (strong, weak, barren, wash) are arranged to discharge onto the top of the vat, and the strong solution line is also connected to the bottom. Effluents are received into six sump tanks, each 8x6 ft., and are pumped by six 2-in. Krogh pumps operated by 3-hp. motors. Four solution tanks are provided on an upper level, each 25 ft. 8 in. inside diameter by 12-ft. stave, for strong, weak, gold, and barren solution respectively. The gold tank is provided with a filter bottom and a 2-ft. layer of coarse sand, which insures clarified solution. The barren solution tank is provided with a solution meter and counter.

Precipitation is effected by the Merrill-Crowe process, the unit consisting of a deoxygenating vacuum receiver, vacuum pumps, steady head sump, filtering tank (eight 3x4-ft. filter leaves), zinc-dust feeder, and a small vacuum filter tank for precipitate clean-up. A 3-hp. motor operates the agitator and zinc-dust feeder, and the two 2-in. centrifugal pumps are each served by a 3-hp. motor, the vacuum pump by a 2-hp. motor. This is a total of 11 hp.

Aëro-brand cyanide is used, a tank with propeller agitator being provided, and a compressed-air chamber (canvas covered) for dissolving and aëration. This tank is out of doors, above the solution tanks. The propeller is operated at 10 to 15 r.p.m. by a ½-hp. motor with speed reducer.

An assay office and a refinery building complete the equipment. The refinery is provided with a vault, No. 150 tilting crucible furnace, 24 x 24-in. ball mill for grinding slab, a Deister table for cleaning refinery slags, and a short Mat-o-Gold rocker, also for slag cleaning. A hood and stack over the furnace connect to a condenser outside, for recovering mercury from the fumes.

The charge is submerged with strong solution, 0.8 lb. sodium cyanide, from the bottom, but thereafter the lixiviant is added on top. Three solution treatments are given: a strong leach of about 16 hours, within which is a standing period of about five hours; a weak leach



Truck discharging into receiving bin at crushing plant

(0.5 lb. sodium cyanide) of about 24 hours; a barren leach (0.4 lb. sodium cyanide) of about 20 hours; and a water wash of about 7½ hours. Solution treatment and washing are completed within 72 hours. The totals of solutions used per vat charge are about 195 tons strong; 90 tons weak; 180 tons barren; 75 tons water wash. A small amount of barren solution is wasted. Ratio of solution to ore is about 2 : 1.

About 400 tons of solution is precipitated per day. At the end of a clean-up, 10 lb. zinc dust is placed in the filter tank; ¾ lb. zinc dust is added per hour during the first 30 hours; and thereafter, 4 lb. zinc dust per shift, or 12 lb. per day. While the initial zinc cake is forming the gold solution is returned to the gold tank, after which it is run to the barren-solution tank. Monthly clean-ups take about five hours. Make-up cyanide is added at the strong-solution storage tanks. One pound of lead acetate per shift is added to the gold-solution tank. Barren solution losses average 5c. per ton. Precipitation is exceptionally good, and this is credited to the presence of mercury, each clean-up recovering about 40 lb.

The following flux is used with 100 lb. of preciptate: 24 lb. sodium carbonate, 32 lb. sand, 40 lb. borax, and 9 lb. manganese dioxide. The melt is poured into a conical mold. After cooling, the gold is separated, returned to the crucible, remelted, and cast into 1,000-oz. bars. Bullion fineness is 455½ gold and 180 silver, in parts per 1,000. Slag is ball-milled and concentrated on the Deister, giving a high-grade slag and fine shot (about $125 per clean-up), and middling. The middling is reground, re-tabled, and passed over the Mat-o-Gold rocker. The final slag product contains sufficient gold to justify shipment to the smelter. The "concentrates" are remelted.

As in all bulk-leaching operations, uniformity of vat charging is essential. Here, finer crushing was found to give more consistent recoveries, though precautions must be taken to avoid an excessive amount of slime. A screen analysis of the tailing gave the following results, in per cent: + 2, 7.2; − 2 + 4, 27.1; − 4 + 10, 20.2; − 10 + 20, 13.4; − 20 + 40, 9.7; − 40 + 60, 5.7; − 60 + 80, 2.3; − 80 + 150, 4.1; − 150, 10.3. Over half the gold in the tailing is in the plus-10-mesh material, a fact that brought about finer crushing and closer sizing. Erratic results were experienced with some vat charges, not entirely explained, although tests seem to indicate excessive oversize and natural slime, and subsequent channeling of leaching and washing solutions.

The results of operation in March, 1931, are as follows: tons treated, 16,847; tons crushed, 16,834; crushing hours, 432.25; tons crushed per hour, 38.15; average tons treated per day, 543.4; average feed, $1.654; average tailing, $0.452; indicated extraction, 72.8 per cent; solution precipitated, 11,060 tons; lime per ton, 8.35 lb.; cyanide per ton, 0.344 lb.; zinc dust per ton of ore treated, 0.0257; and zinc dust per ton of solution precipitated, 0.0382 lb.

Cyanide plant capital cost was $75,000; quarry equipment required an additional $25,000. Labor distribution is as follows: three truckmen, one shovel man, three quarrymen (average), two mechanics, two grizzly men, two crusher men, two tripper men, two vat men (filling), six vat unloaders, one assayer, one helper, three solution men, one tailing man, one roustabout, and one electrician—a total of 31.

Trucks are charged $3 per hour, and the power shovel is charged at the rate of 8c. per ton. Mill power requirements were 3.06 kw.-hr. per ton during March, and the quarry was charged with 0.5 kw.-hr. per ton exclusive of the power required by the electric shovel (50-hp. motor). Quarry power consumption is principally for compressed air used in blockholing.

The average per ton costs for March (1931), which are fairly representative, were as follows:

Quarry: Labor, $0.051; material, $0.058; power shovel, $0.08; quarry power, $0.004; machine drills, $0.002; local general expense, $0.036; local administration, $0.018; trucking gossan, $0.136; total, $0.385 per ton. *Mill:* Labor, $0.182; material, $0.176; power, $0.031; local general expense, $0.024; local administration, $0.015; expressage and incidentals, $0.004; total, $0.432. Total quarry and mill, $0.817 per ton.

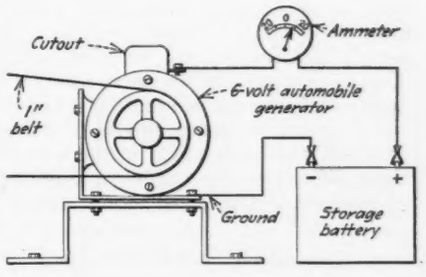
William F. Kett is general manager for the company; M. J. Murphy is mine superintendent; J. M. Basham, who erected the plant, is mill superintendent; E. R. Hathaway is assayer; and W. S. Howard is chief accountant. The consulting engineer is Albert Burch, and the C. W. Merrill Company gave valuable assistance in developing the details of the cyanide treatment.

Successful cyaniding of a low-grade copper-bearing ore for its precious-metal content is of considerable interest. The porous nature of the ore, the fact that the gold is disseminated in minute particles—in spite of careful panning tests, no free gold has ever been detected—and the use of extremely dilute cyanide solutions seem to be some of the important factors that have contributed to the success of the enterprise. The decision to bulk-leach the crushed ore without separation of fines and agitation treatment has resulted in low operating costs. Availability of a highly efficient operating organization, thoroughly familiar with local conditions, has been particularly important.

■ ■

Charging Small Batteries

WHEN proper charging facilities are not available, small storage batteries, used for numerous purposes at most plants, can be effectively charged, at low cost, with the set-up shown in the accompanying sketch, writes E. W. Baker, mechanical engineer, Hope Metals Company, Winkelman, Ariz. The equipment consists of a six-volt automobile generator, purchased from an automobile wrecking concern; an angle plate; and a metal base containing four holes to accommodate the anchor bolts or lagscrews. Both plate and base are made of 1/2x5-in. strap iron. Power to drive the generator can be taken from a line shaft, or any exposed rotating part of a fan or pump.



The wiring of the installation is simple. The live or "hot" lead from the generator, equipped with a standard automobile ammeter, is attached to the positive terminal of the battery to be charged, whereas the negative terminal is grounded to the generator base. To afford a quick attachment and removal of the positive and negative wires, the end of each is fitted with a small spring clamp. Inasmuch as the charging rate of this type of machine is adjustable, by means of a third brush, the speed of the generator may range from 800 to 1,200 r.p.m. Employing a charging rate of 10 or 12 amp., a battery can be fully charged in eight hours. Although this rate may appear to be high, no damage has been noted to two batteries that were charged regularly once a week, for eighteen months, at a charging rate of 14 amp. Care must be taken, however, that each battery before being charged contains the proper amount of solution. A large bottle of distilled water and a hydrometer should always be available in the battery-charging room.

Innovations in Accident Prevention

J. B. Huttl
Assistant Editor

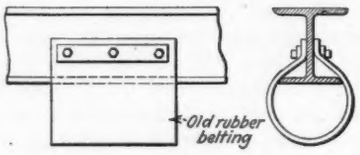


Fig. 1

Rubber guard protects men from head injuries

STATISTICS compiled from an analysis of the causes of industrial accidents at numerous plants show that, speaking in general terms, about 80 per cent of all accidents may be attributed to the lack of a whole-hearted safety program. Only from 10 to 20 per cent are the result of physical causes. In other words, insufficient interest on the part of the management, inadequate instruction, lack of discipline, negligence in providing protective devices on the surface and underground, and ignorance —a vital factor where an inferior grade of labor is employed—are responsible for practically all industrial accidents.

The Phelps Dodge Corporation, one of the first organizations to recognize the importance of this work, has set many examples for industry by intelligent application of safety-first principles. This is particularly true of the company's Mexican branch, the Moctezuma Copper Company, at Nacozari, where the type of labor employed and local conditions presented many problems. The excellent results obtained in the face of these difficulties are worthy of study by all engineers. Concerted action—that is, sound leadership and a judicial selection of operating personnel on the part of the management, and interest, patience, and intelligent application on the part of the superintendent and foremen—has overcome many difficult problems. Much of the success achieved is the result of constant vigilance to correct unsafe conditions underground and on the surface. The part that hard-boiled hats, leather gloves, electrically controlled signals, and other mechanical contrivances play in accident prevention is well known; but as ideas and methods differ at every property, the presentation of a few innovations introduced by Moctezuma Copper may be helpful.

Head injuries at the surface plant have been reduced to a minimum through the installation of a simple and inexpensive guard on all I-beams, channels, angle irons, and traversing passageways. This guard, shown in Fig. 1, is made of old rubber belting and scrap material. Underground, the arrangements illustrated in Figs. 2 and 3 have overcome the hazard of men falling into ore or waste chutes while mucking or dumping cars. The flexible steel guard covering the opening of the chute on the floor of the stope is made of worn grinding rods and contains one small bolt. Spaced diagonally, the rods offer no obstruction whatsoever to a shovel or a scraper. A wood-frame curtain suspended from two overhead brackets, and equipped with a counterweight at the bottom, shown in Fig. 3, returns by gravity to its original position over the mouth of the chute, after being temporarily pushed aside by the revolving body of the car as it is being dumped.

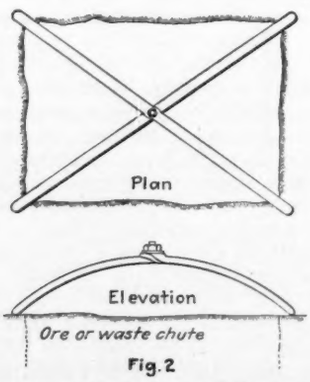


Fig. 2

Guard, made of worn grinding rods, prevents falls into chutes

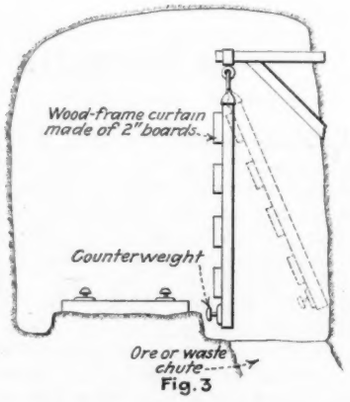


Fig. 3

Curtain guarding waste chute

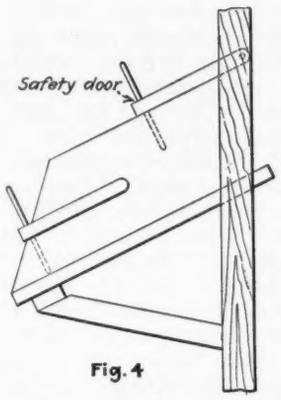


Fig. 4

A second safety door stops falling lumps of ore

Accidents frequently occur at the ore-loading chutes. When the chute door is opened the pressure existing in the storage pocket may suddenly start a rush of ore, impossible to check by merely closing the door. Head injuries caused by falling boulders are often the result. To overcome this hazard, a second door is provided on each standard chute, as shown in Fig. 4. Stuck ore bins and passageways are common occurrences in the mill during the rainy season. To crawl into such a bin or chute and place dynamite to blast the obstruction away involves a great hazard. A good solution of this problem is to provide hand holes at strategic points, as shown in Fig. 5, so that the dynamite may be placed from the outside. An ingenious searchlight, illustrated in Fig. 6, consisting of a small mirror and an electric light bulb and reflector, mounted on a light wooden handle, has been devised to facilitate this operation.

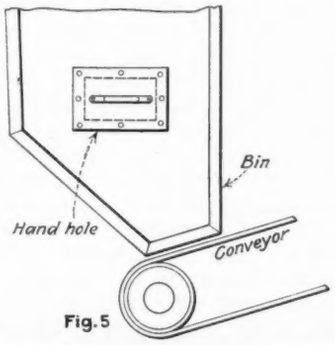


Fig. 5

Hand holds for inserting explosives in "hung-up" bins or chutes

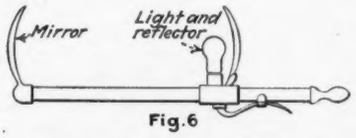


Fig. 6

A searchlight that aids in placing explosives

New Publications

Rift Valleys and Wild Life

LIVING AFRICA. *By Bailey Willis. Whittlesey House, McGraw-Hill Book Company, New York. $4 or 16 shillings.*

THIS is the narrative of the author's wanderings in the earthquake region of Central Africa, whither he had gone to study the rift valleys of that part of the earth. The story runs that Dr. Willis had no intention of writing this book, but, having mailed his daily journal home to Mrs. Willis from time to time, found on his return that she had prepared it for publication in the form in which it now appears, and that it was already on the press. For this every reader will feel indebted to the lady. The tale is charming in its beauty of description and its unexpected, delightful humor. Observations on geology and native customs are mixed informally with glimpses of big game—elephants, the gorilla at home in the forests of the volcano region, where Carl Akeley had studied him—the rhino, lion, and hippo, and a dozen others. "The wart hog is a scream," says Dr. Willis. "Excuse me, but he is, you know. And when he is little he is a perfect darling of a scream. We chased several families just to laugh at the absurd figure they cut. . . ." The trip was no Cook's tour, but a well-organized journey by motor, foot, and water to little-visited regions through which the author moves as casually as if he were walking in Central Park. Although he has been many places, he displays the enthusiasm of a boy—it is his first trip to Africa, and such a trip! His lapses into geology will interest, not confuse, the layman. At the outset, he formulates the geological question as to the origin of the rift valleys, to answer which he had gone abroad. In the end, he frankly leaves it unanswered. It has grown to be a broader question, he says, involving fundamental ideas of the earth's activity. But he bids goodby to those who adhere to the school of thought established by Suess on the concept that gravity is the strongest force of the earth. "The foundering of continental masses to the depths of ocean basins and the drifting of continents across the face of the globe," he says, "find no support in the story of Africa." Everywhere within the continent the foundation rocks bear witness to uplift. "The movements have been slow but mighty. It takes power to lift a continent. Whence comes that power?" He suggests crystal growth as the answer, saying: "Over regions where crystals grow horizontally, basins develop. Where crystals grow vertically, continents rise."

A. H. HUBBELL.

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LEHRBUCH DER ERZMIKROSKOPIE, Vol. II. *By H. Schneiderhöhn and P. Ramdohr, Pp. 714; illus. Berlin: Geb. Borntraeger, Schoneberger Ufer 12a.; gebd. 72 RM, geh. 69 RM.*

AN excellent work, this, profusely illustrated with color plates and half-tone reproductions of photomicrographs, and text figures. The volume, prepared with characteristic painstaking German thoroughness and attention to detail, should prove an invaluable adjunct to laboratory investigations of ores in which microscopic studies are essential. It should be in the hands of every student of ore deposits and every petrographer as well.

Descriptions of individual minerals include a brief statement covering the composition, crystallography, and physical properties of the individuals, and more extended and detailed descriptions of the behavior of the various minerals on polishing, and the color, appearance, reflecting capacity, and the behavior in polarized light and between crossed nicols, as observed under the microscope from polished plates. Structural features and grain characteristics are likewise discussed and quantitative measurements of the reflecting capacity, determined in red, green, and orange light by means of a "photometer ocular," are tabulated. The "photometer ocular" is a new accessory devised by M. Berek, a description of which is in press.

The authors describe in detail the microscopic characters of 199 elements, simple sulphides, complex sulphosalts, strongly reflecting oxides and oxidized ores, and a few of the common gangue minerals. An extensive bibliography, containing 618 citations, is a valuable feature of the book. I am glad to recommend this work heartily.

R. J. COLONY.

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HIGH-SPEED STEEL. *By Marcus A. Grossmann and Edgar C. Bain. Pp. 178; illus. New York: John Wiley & Sons; $3.50. London: Chapman & Hall, Ltd.; 17s. 6d.*

Addition of alloying elements to steel has resulted in the production of metal in which certain desirable properties may, at will, be greatly intensified. This book presents a general view of the manufacture and properties of high-speed steel. Part I deals with hammering and rolling of ingots and bars, heating operations during fabrication, and the preparation and heat-treatment of finished tools. Part II treats physical properties; constitutional diagrams; microstructure under various conditions of manufacture and heat-treatment; and their correlation with the ultimate mechanical properties. A new concept of the nature of red-hardness, developed by one of the authors, has been presented; also an account of the magnetic properties, chemical constitution, and shrinkage behavior.

■ ■

THE IRON ORES OF LAKE SUPERIOR. *By Crowell & Murray, Inc., Penton Press Company, Cleveland, Ohio. Pp. 332; $6.*

Each new edition of this book, which has appeared triennially since 1913, has shown improvement. The latest constitutes an excellent text on the iron-mining industry of the Lake Superior region. Of its chapters, the eleventh and last takes up almost 200 pages and is devoted to a description of mines and ores by districts.

The first nine chapters cover the following topics: early history of the region; geology of the district; local mineralogy; methods of exploring for and estimating iron ore; classification and sampling of Lake ores; methods of analysis; valuation of ores; tables and charts; and ore dock equipment. Chapter X comprises five special articles—"Mining Practice in Lake Superior Iron Ore Region," by C. F. Jackson; "Preparation of Cargoes at the Mines," by E. R. Bayer; "Iron Ore Reserves of Lake Superior District," by M. C. Lake; "Economics or Iron Ore Beneficiation," by C. P. McCormack; and "Manganese," by Carl Zapffe.

■ ■

SURVEYING CALCULATIONS. *By Frederick Winiberg. London: Mining Publications, Ltd. 25s. New York: Engineers Book Shop; $8.*

THIS BOOK deals mainly with the calculations incident to mine surveying. Although primarily intended for use in conjunction with the text, "Metalliferous Mine Surveying," by the same author, it is of value independently, inasmuch as it brings together the solutions of many problems heretofore not available in one volume. For this reason, the book is as useful to the practicing mine engineer as to the student. Many of the inaccuracies in mine surveying are caused by applying graphical methods to the solution of problems that should, instead, be solved by calculation. Such errors are particularly liable to occur if a mine map drawn to

a small scale is used. For example, suppose a crosscut with a known starting point and direction were to be driven to connect with a drift. If it were desired also to drive the crosscut simultaneously from the drift, then the point where the drift and crosscut will intersect must first be determined, and the problem becomes one of finding the coordinates of the point of intersection. The average mine surveyor would solve the problem on the mine plan, extending the crosscut line and scaling off the distance to the point of intersection from a known point along the drift. Mr. Winiberg presents a lucid and preferable solution by the application of coordinate geometry.

Subjects discussed by the author include the calculation of area by means of coordinates, a method of alternative to the use of the planimeter, and of greater accuracy; the plotting of points by means of chords, as an alternative to the use of the protractor; several methods of plumbing a shaft for the transference underground of surface survey stations; the mathematics of errors in surveying observations.

One criticism that may be made of the volume is that it presents, under simple traverse calculations, an extra step in the determination of quadrant bearings, as compared with the procedure generally employed in surveying practice. The work is highly recommended for its practical value to the engineer and student, and for the clear, concise manner in which it is written.

G. A. CLAYBERG.

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ARTIFICIAL SUNLIGHT. *By M. Luckiesh. New York: D. Van Nostrand Company, Inc.; $3.75. London: Crosby-Lockwood & Son.*

This treatise will prove of interest to those in the mining industries who have followed the progress being made by Mr. Stanly Easton in the health-ray treatments being given to the employees and their families at the Bunker Hill & Sullivan property in Idaho—an example of commendable pioneering that deserves emulation elsewhere.

Dr. Luckiesh is an authority on the subject of light. In this book he stresses the obvious relation, usually overlooked, between health and sunlight, especially summer sunlight. Even as artificial illumination is needed to permit full utilization of the hours of darkness, so — in most climates — is needed provision for adjusting a deficiency of sun rays in winter, or of bringing the healthful qualities of such rays to those who habitually work underground. The subject is treated by Dr. Luckiesh with skill and sympathy, and the book will prove a valuable help to those who accept responsibility for the physical condition of their employees, and who are now able to keep abreast of current research and knowledge on the subject of artificial light.

The Days of '49

ONE MAN'S GOLD. *By Florence M. Christman. New York: Whittlesey House, McGraw-Hill Book Company; $3.*

WAGONS WEST. *A Story of the Oregon Trail. By Elizabeth Page. New York: Farrar & Rinehart; $5.*

A YANKEE TRADER IN THE GOLD RUSH. *By K. A. White. New York: Houghton Mifflin Company; $3.50.*

THE appearance of not fewer than three books on "the days of '49" within a few weeks of each other is explicable only as a coincidence. The first, "One Man's Gold," consists of letters written to and by one Enos Christman, apprentice to a Pennsylvania printer, with minor additions by his granddaughter, who has edited the volume. He voyaged to California via the Horn, underwent the usual hardships, met with the customary disappointments, and was for a short time the editor of the *Sonora Herald.* He returned by sailing vessel, by way of Panama, bringing to an end a journal that complements previous records.

In "Wagons West" Miss Page relates the adventures of a great-uncle, as told in personal letters to relatives and friends, prefaced and supplemented by comments and information on the experiences of one of the many from the Atlantic seaboard who fell victims to the gold fever of the 'forties. The account constitutes another record of the period, colored with picturesque details of the early days of mining in California, of the trials and tribulations of those who survived the hardships of the journey across the continent, to achieve negligible material success in reward for initiative and courage.

The life of Franklin A. Buck, described in "A Yankee Trader in the Gold Rush," was not dissimilar to that of many of his contemporaries, but this excellent collection of letters reveals an intelligence above the ordinary and an interest in life that can now be shared by an audience beyond those to whom the letters were written. After an introduction by his daughter, the first letter is reproduced, dated Nov. 24, 1846. News of fortunes being made in California inspired the young man, who after the adventures incident to a trip around the Horn, eventually reached San Francisco on Aug. 6, 1849, immediately to plunge into the life of the Golden State at the period of its most hectic youth. After sundry successes and vicissitudes he decides to settle at Oakville, from where the last published letter is written, dated Jan. 22, 1881. "I have given up the idea of ever finding a rich mine or of making a fortune in stocks," he says. "I have given it a fair trial, but such things are not for me, so I am setting out trees and making myself comfortable for life right here . . . a beautiful climate . . . almond trees just ready to burst into bloom. . . ."

Buck was a man of natural culture and intelligence, both of which qualities are reflected in letters that form an interesting human document and an excellent historical account of California in the early days. A. W. ALLEN.

■ ■

HANDBOOK FOR PROSPECTORS. *By M. W. von Bernewitz. Pp. 359; illus. New York: McGraw-Hill Book Company; $3. London: McGraw-Hill Book Company, Ltd.; 15s.*

Since its publication in 1926, this volume has become the recognized handbook on prospecting. To the material that was presented in the earlier work, there has been added, in this second edition, that which is new and important. Recent information on certain minerals, for instance, is included. A well-prepared chapter on geophysical prospecting, with its bibliography and numerous citations, affords a comprehensive outline of this comparatively new science. Automobile, motorcycle, and airplane transportation are discussed, in addition to the other older forms, and, in the chapter dealing with foods and rations, Admiral Richard E. Byrd is quoted on the value of pemmican for sledging journeys. These few references typify the up-to-date character of the entire handbook.

■ ■

ENGINEERING GEOLOGY. *By H. Reis and T. L. Watson. Fourth Edition; 708 pp.; illus. New York: John Wiley & Sons; $5. London: Chapman & Hall; 25s.*

The appearance of the fourth edition of this excellent textbook, first published in 1914, is evidence of its authority and quality, and a tribute to the publishers as well as to the authors. A general revision has been made and new references have been added, together with a chapter on the geology of reservoirs and dam sites, a subject about which much discussion has centered since the occurrence of failures in California in recent years.

■ ■

WORKING OF SEMI-PRECIOUS STONES. *By J. H. Howard, Peekskill, New York: Rocks & Minerals; $1.*

This helpful monograph with working instructions in non-technical language on the cutting and polishing of semi-precious stones, will prove of especial interest to geologists and engineers who are in a position to indulge in a hobby of educational and aesthetic value.

■ ■

ANNUAL REPORT OF THE GOVERNMENT MINING ENGINEER, *Department of Mines and Industries of the Transvaal, South Africa, with statistics and charts. Pretoria: Government Printers; 10s. 6d.*

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Hammer Mill. No. 1,797,107. March 17, 1931. A. L. Veeder, assignor to V. & L. Mill and Feeder Corporation.

Ore Reduction. No. 1,797,130. March 17, 1931. H. E. Coley.

Scrap Furnace. No. 1,797,276. March 24, 1931. T. D. Stay and H. O. Burrows, assignors to Aluminum Company of America.

Flotation Process. No. 1,797,356. March 24, 1931. R. B. Martin, Roselle, N. J.

Electrolyzing Cell. No. 1,779,375-77. March 24, 1931. J. N. Smith, assignor to Westinghouse Electric Company.

Drilling Mechanism. No. 1,797,445. March 24, 1931. T. R. E. Rundqvist, assignor to Sullivan Machinery Company.

Electric Blasting Cap. No. 1,797,509. March 24, 1931. H. A. Lewis, assignor to E. I. du Pont de Nemours & Company.

Magnetic Separator. No. 1,797,597. March 24, 1931. G. Ullrich, assignor to Fried Krupp Grusonwerk.

Mine Car. No. 1,797,644. March 24, 1931. R. L. Edgar, assignor to Watt Car & Wheel Company.

Excavation Scoop. No. 1,797,642. March 24, 1931. R. R. Downie, assignor to Keystone Driller Company.

Aluminum Oxide. No. 1,797,655. March 24, 1931. T. R. Haglund.

Matte Smelting. No. 1,797,700. March 24, 1931. H. Skappel.

Aluminum-Base Alloy. No. 1,797,851. March 24, 1931. T. W. Bossert and J. A. Nock, Jr., assignors to Aluminum Company of America.

Sintering Machine. No. 1,797,931. March 24, 1931. G. E. Storer, assignor to National Process, Ltd.

Copper Extraction. No. 1,798,255. March 31, 1931. W. E. Greenawalt.

Purifying Alumina. No. 1,798,261. March 31, 1931. B. T. Horsfield, assignor to Aluminum Company of America.

Shaker Screen. No. 1,798,433. March 31, 1931. E. L. Rigdon and J. S. Risley, assignors to Clyde Equipment Company.

Flotation Apparatus. No. 1,798,452. March 31, 1931. W. A. Butchardt.

Burning Carbonate Rock. No. 1,798,802. March 31, 1931. G. H. Niles, assignor to Doherty Research Company.

Zinc Distillation. No. 1,798,986. March 31, 1931. A. Roitzheim and W. Remy.

Zinc Metallurgy. No. 1,799,278. April 7, 1931. W. O. Borcherdt, assignor to New Jersey Zinc.

Tantalum Electrolysis. No. 1,799,403. April 7, 1931. C. W. Balke, assignor to Fansteel Products Company.

Crusher. No. 1,799,476-77. April 7, 1931. R. C. Newhouse, assignor to Allis-Chalmers.

Rock-Drill Chuck. No. 1,800,390. April 14, 1931. A. H. Katterjohn, assignor to Gardner-Denver.

Zinc Distillation. No. 1,800,500. April 14, 1931. W. F. Bleeker.

Sintering Machine. No. 1,800,571. April 14, 1931. E. W. Shallock, assignor to American Ore Reclamation.

Blasting Cap. No. 1,800,954. April 14, 1931. H. E. Nash and L. W. Babcock, assignors to Hercules Powder Company.

Drill-Steel Coupling. No. 1,800,998. April 14, 1931. C. C. Hansen, assignor to Ingersoll-Rand.

Flotation of Ore Prior to Cyanidation. No. 1,801,105. April 14, 1931. R. E. Phelan, S. P. Lowe, A. B. Clampitt, H. T. Koenig, and O. A. Fischer, assignors to R. H. Channing, Jr.

Flotation Reagents. No. 1,801,317-20. April 21, 1931. F. G. Moses, R. W. Hess, R. L. Perkins, assignors to The Barrett Company.

Treatment of Slime from Lead Refining. No. 1,801,339. April 21, 1931. J. J. Fingland, A. D. Turnbull, P. F. McIntyre, assignors to Consolidated Mining & Smelting Company of Canada.

Hammer Mill. No. 1,801,604. April 21, 1931. C. A. Jamison, assignor to Pennsylvania Crusher Company.

Filter. No. 1,801,662. April 21, 1931. E. R. Crutcher, E. Waltman, W. G. Woolf.

Hammer Mill. No. 1,802,105. April 21, 1931. G. W. Borton, assignor to Pennsylvania Crusher Company.

Oxy Compounds of Tantalum and Columbium. No. 1,802,242. April 21, 1931. C. G. Fink and L. G. Jenness.

Grinding Machine. No. 1,802,389. April 28, 1931. C. H. Norton, assignor to Norton Company.

Mine-Ventilating Tubing. No. 1,802,414. April 28, 1931. W. H. Evans, assignor to Du Pont de Nemours & Company.

Chromium Plating. No. 1,802,463. April 28, 1931. C. G. Fink, assignor to Chemical Treatment Company.

Fuse Cutter. No. 1,802,515. April 28, 1931. J. Kaiser.

Induction Furnace. No. 1,802,701. April 28, 1931. P. H. Brace, assignor to Westinghouse Company.

Induction Furnace. No. 1,802,707. April 28, 1931. N. R. Davis and P. G. H. Burbridge, assignors to Westinghouse Company.

Gas-Analysis Apparatus. No. 1,802,713. April 28, 1931. W. O. Hebler, assignor to C. Engelhard.

Extracting Minerals from Stream Beds. No. 1,802,836. April 28, 1931. J. W. Rowley.

Drill-Steel Retainer. No. 1,802,983. April 28, 1931. W. Prellwitz, assignor to Ingersoll-Rand.

Rock Drill. No. 1,802,987. April 28, 1931. J. F. Shook, assignor to Ingersoll-Rand.

Flotation of Metals. No. 1,802,989. April 28, 1931. G. G. Thomas, assignor to American Cyanamid Company.

Drilling Mechanism. No. 1,803,242. April 28, 1931. E. G. Gartin, assignor to Sullivan Machinery Company.

Tool Mounting. No. 1,803,243. April 28, 1931. E. G. Gartin, assignor to Sullivan Machinery Company.

Mine Car. No. 1,803,376. May 5, 1931. L. Almquist, assignor to American Car & Foundry Company.

Mine Car. No. 1,803,392. May 5, 1931. W. V. Johnson, assignor to American Car & Foundry Company.

Hammer Crusher. No. 1,803,581. May 5, 1931. W. A. Battey, assignor to Pennsylvania Crusher Company.

Zinc Condenser. No. 1,803,611. May 5, 1931. H. A. Grine, assignor to Grasselli Chemical Company.

Production of Blister Copper. No. 1,803,663. May 5, 1931. G. C. Carson, assignor to Carson Investment Company.

Removing Arsenic from Lead Bullion. No. 1,803,771. May 5, 1931. R. C. Rutherford, assignor to American Smelting & Refining.

Grinding Machine. No. 1,803,807. May 5, 1931. C. H. Norton, assignor to Norton Company.

Refining Lead. No. 1,804,054. May 5, 1931. C. R. Hayward.

Drill Mounting Shell. No. 1,804,187. May 5, 1931. E. F. Terry, Jr., assignor to Gardner-Denver.

Personal Notes . . . Comment . . . Criticism

H. W. Hardinge and **Mrs. Hardinge** are motoring through the West and Southwest. They expect to continue until midsummer.

William F. Hayden, of Salt Lake City, Utah, has been made vice-president of Pacific Minerals, operating at Gold Beach, Ore.

Walter C. Shunk has been appointed mining engineer with the Goodman Manufacturing Company. His headquarters will be at the factory in Chicago.

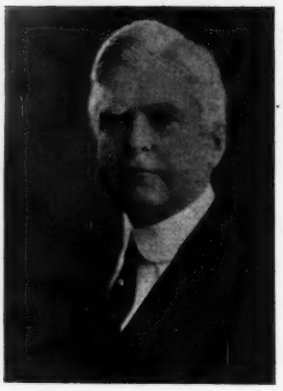
H. D. Cooley, Jr., formerly assistant manager of Butte & Superior, at Butte, Mont., has accepted a position in the New York office of the Jackson-Hayden-Stone interests.

J. S. Tritle has been appointed vice-president and general manager in charge of manufacturing, sales, and operations of the Westinghouse Electric & Manufacturing Company.

C. C. Samuels, of Wallace, Idaho, manager of the Sunshine Mining Company, is at the Deaconness Hospital, Spokane, Wash., recovering successfully from severe injuries sustained in an automobile accident last month.

A. B. Peach is supervising operations at the Vulture mine, near Wickenburg, Ariz., for United Verde Extension, succeeding **Dan R. Finlayson,** who is now in charge of other work at the mine and at other properties in the district.

Dr. Charles Camsell, Deputy Minister of Mines and Industries of Canada, has been awarded the gold medal of the Institution of Mining and Metallurgy, in tribute to his "untiring zeal and great ability in promoting the development of the natural resources of the Dominion. . . ."



George S. Rice, Chief Mining Engineer of the United States Bureau of Mines, was presented with the University Medal of Columbia University at the recent commencement exercises. In the course of remarks made while presenting the medal, President Butler of Columbia designated Mr. Rice as the "foremost authority on safety appliances in mines, honored by scientific societies in many lands for contributions to the literature of mining engineering." Mr. Rice graduated from Columbia School of Mines in 1887, and subsequently served on the technical staffs of several companies operating in the West. He has held his present post since the inception of the Bureau of Mines in 1910. His work in mine safety was recognized by the British Institution of Mining Engineers in 1929 by the award of its medal.

E. H. Denny, head of the safety work conducted in the Southwest by the United States Bureau of Mines, was in charge of the second annual first-aid contest held at El Paso, Tex., recently. **G. M. Kintz,** in charge of the Bureau's mine safety car, directed the program.

E. G. Lawford, who served on the editorial staff of this publication prior to his present connection with Rio Tinto in London, has been awarded the Consolidated Goldfields premium for his paper on "Stoping Problems in Mexico," published in the *Transactions* of the Institution of Mining and Metallurgy. This premium is one of the annual awards of the Institution.

Elmer Isern, metallurgical engineer of the Commerce Mining & Royalty Company, Miami, Okla., and author of "Central Mining in the Tri-State District," which appeared in a recent issue of this publication, has been retained as consulting engineer by the Eagle Picher Mining & Smelting Company, to design the 3,600-ton central mill that the company proposes to erect soon at Picher, Okla.

F. E. Johnesse, former mineral examiner with the United States Department of the Interior; and W. G. Huseman, mining engineer, have formed the Western Mines Agency, with offices in the First National Bank Building, Boise, Idaho. The agency acts as a clearing house for prospective buyers and sellers of mining properties, and a list of properties that are for sale will be prepared monthly.

Sam A. Lewisohn, treasurer of Miami Copper, will attend and participate in the World Industrial Relations Congress to be held at Amsterdam late in August this year. Major emphasis at the meetings will be paid to the need for planned adjustment of productive capacity and standards of living. Other delegates include **V. I. Meshlauk,** vice-chairman of the Supreme Economic Council of the Soviet Union and in charge of the metallurgical industries of the U.S.S.R.

A. C. Fieldner, Chief Engineer, Experiment Stations Division, United States Bureau of Mines, has been awarded the Lamme Meritorious Achievement Medal by the Ohio State University. This gold medal is awarded annually to a graduate of one of the departments of the University for achievement in engineering or the technical arts. Mr. Fieldner is a member of the first class in chemical engineering graduated from Ohio State, and one of the first two recipients of the Lamme Medal.

Frederick M. Feiker, manager since 1927 of the Associated Business Papers, Inc., has been designated by President Hoover as Director of the Bureau of Foreign and Domestic Commerce, one of the largest and most important bureaus of the government organization. In 1921 the McGraw-Hill Publishing Company acceded to the request of Secretary of Commerce Hoover to lend him the services of Mr. Feiker for the purpose of developing the contacts of the Department of Commerce with industry and trade. Mr. Feiker left the posts of editorial director and vice-president of the McGraw-Hill company to take his first appointment in Washington. During the last few years he has acted in a consulting capacity to the Department of Commerce.

Among Our Contributors:

Charles A. Mitke, a graduate of Yale and the Sheffield Scientific School, has been generous to his confrères in sharing with them the results of his researches and professional experiences. For several years he acted as consultant to the Phelps Dodge, Inspiration Copper, Arizona Copper, Iron Cap, United Verde Extension, and other copper companies, specializing in mining and allied methods, in which subjects he has also stimulated interest by articles and textbooks. Mr. Mitke recently returned from the Mount Isa mines, in Queensland, Australia, at the conclusion of work that involved the planning of underground operations for Mining Trust, Ltd., of which company he is a member of the Technical Committee. The article from his pen in this issue reveals a versatility of interest and an appreciation of the value of cordial industrial relations in the conduct of a technical enterprise. Mr. Mitke left New York for Cyprus on June 13. **Dipl. Ing. P. Erimescu** is a graduate in mining engineering of the Bergakademie Freiberg, where he received an award for a study of the principles underlying fine grinding. He is now assistant manager of the ASW company, at Hirschfelde, Saxony, after underground and surface experience at the other principal Continental mining centers. **Owen Letcher** is editorial correspondent for this publication at Johannesburg, Transvaal, South Africa. A brief biographical note outlining the career of **Frank H. Probert** appeared in the issue of *Engineering and Mining Journal* for May 25.

The Depletion Situation

To the Editor of "E.&M.J.":

To quote from a summary of the depletion situation by J. R. Finlay, published in a recent issue: "There are, it seems, two suggestions: (1) to do away with the provision for depletion altogether, and (2) to make the provision arbitrary and permanent according to average, not individual, cases, so that the mining industry as a whole will pay the required aggregate of taxes." As to the first suggestion, although it unfortunately finds support in some quarters, realization should be had of the fact that mines already are paying more than their just share under the taxing measures of the states, and more than other enterprises and types of property. To abolish the proper allowance for depletion would only add to the unequal burden in a manner that is without warrant; however, this suggestion is frequently made in legislative circles.

Much has been written on the question as to whether or not depletion is an inherent right under our income-tax law, or whether it is a statutory concept subject to Congressional action. Although it has been urged that the point was missed in some of the earlier decisions, when it was held that the miner had no inherent right to a deduction for depletion, the Supreme Court of the United States has very recently indicated that depletion is a statutory concept. In the decision in Burnet vs. Thompson Oil & Gas Company, handed down on April 13, 1931, the Court said: "The parties agree that respondent is not entitled as matter of right to make any deduction from annual income for depletion of oil extracted and sold during the year. If it may take any such deduction, authority therefor must be found in the statute."

Although many in Congress view depletion as a subsidy to the mining industry which other lines of endeavor do not enjoy, this thought is confined largely to those quarters where mining is not understood and where depletion is not viewed as it should be—namely, nothing more nor less than proper provision for the tax-free return of the cost of goods sold.

The Kiplinger Tax Letter of April 20, 1931, states as one of the typical suggestions made recently with regard to tax revision, a proposal to restrict the depletion allowance by: "Revision of depletion basis to provide a depletion allowance upon basis of actual investment." That amendment of the depletion provisions will be considered by the 72d Congress seems certain. Various changes have been proposed —liberalization of the discovery clause, unit depletion, a percentage of gross income, a fixed percentage of net income. The last-named method was given preference in the Preliminary Report on Depletion by the staff of the joint committee on Internal Revenue Taxation, and was embodied in the bill introduced in the House of Representatives by Congressman C. B. Timberlake, of Colorado, on Feb. 3, 1931, as follows:

"(2) Percentage Depletion for Mines.—In the case of mines the allowance for depletion shall be 33⅓ per centum of the taxpayer's net income as defined in the Section 21 (Computed (a) without allowance for depletion, and (b) excluding such items of gross income and deductions as are not directly attributable to the operations of mineral or metal production from the property), except that in no case shall the depletion allowance be less than it would be if computed without reference to this paragraph."

The direction and extent of such changes as may be considered by the 72d Congress appear to be dependent upon the degree to which those who are concerned in the depletion allowance may agree upon some plan that will simplify the present procedure, permit of a greater measure of equity in the allowance granted, and not affect the governmental revenue adversely. If one group urges extension of discoveries, another a unit basis, others a percentage of gross income, and still others a percentage of net income, the chances of enactment of any beneficial proposal will be nil. In such a contingency there is always the possibility of the entire depletion allowance being jeopardized. Mr. Finlay has suggested as the alternative to the proposal "to eliminate the allowance, to make the provision arbitrary and permanent according to average, not individual, cases, so that the mining industry as a whole will pay the required aggregate of taxes."

The percentage principle has proved satisfactory in the petroleum industry. It has been in successful operation in Canada for many years. It has been recognized and adopted for local taxation purposes in several of the mining states. Mr. Finlay concludes, "It seems reasonable to believe that the depletion on a percentage basis, like that already adopted for the petroleum industry, and by the Dominion of Canada, would prove sounder and more equitable."

If some unanimity of opinion throughout the mining industry may be had, the adoption of a stable and permanent basis for the depletion allowance may reasonably be expected. It is trusted that Mr. Finlay's article may assist in the crystallization of thought on this subject, which is of such vital import to the mining industry.

Portland, Ore. A. W. STROWGER.

Natural-Gas Installation Costs

To the Editor of "E.&M.J.":

In regard to the article by A. H. Hubbell on "Natural Gas," in the May 25 issue, I append a statement showing the cost of installation at the El Paso smelter of American Smelting & Refining, which includes the lead department as well as the cost of running lines to the staff residences, to American tenements, and to our stack heaters:

Main control station	$4,835.25
General pipe lines, copper department (reverbs., roasters, anode, stack heater)	3,415.35
General pipe lines, lead department. Staff residences and stack heater	3,028.86
General pipe lines, direct-fired boilers. Drossing plant, laboratory, warehouse, American tenements	3,082.19
Staff residences—Meters, regulators, etc.	700.00
American tenements — Meters, regulators, etc.	1,800.00
Equipment—Four 7-hearth Wedge roasters	1,155.42
No. 1 Reverb., copper dept.	5,456.24
Reverb., control station	777.00
Two anode furnaces	2,000.00
Copper-plant stack heater	655.70
Four Dwight-Lloyd sintering machines	1,605.00
Lead department, stack heater	508.00
Power house, direct-fired boilers	6,730.00
Lead-drossing plant, four kettles	700.00
Lead-dross reverb. furnace	450.00
Laboratory and assay office	803.00
Calorimeter room (for determining B.t.u. content of gas)	756.31
Total cost	$38,458.32

BRENT N. RICKARD.

El Paso, Tex.

Consolidated's Metallurgy

To the Editor of "E.&M.J.":

I have read with interest the article by George J. Young, associate editor, relative to lead smelting and zinc fuming at Tadanac, B. C. I was particularly interested in the description of the new blast furnaces, especially the No. 12 furnace, and to the system for the cooling water for the jackets which Mr. Young describes as an "economizer." Mr. Young also states: "Although the ideas involved in reducing the amount of cooling water were developed at Tadanac, it was later found that they had also been applied several years before in Colorado."

Mr. Young is misinformed on this point, as the system used is the Nesmith jacket-water vaporizer, which was developed a number of years ago by the late John W. Nesmith, then president of the Colorado Iron Works Company, and was successfully used on a number of Colorado Iron Works blast furnaces for both lead and copper smelting, with a large saving in the amount of jacket water used, and greatly prolonged life of the water jackets.

I operated a copper-matting furnace in 1912 and 1913, with an exposed jacket area of 414 sq.ft., and by actual measurement the water consumption for the furnace jackets was found to be 0.00362 gal. per minute per square foot of jacket area. For comparison it might be stated that the jacket water consumption on copper-matting furnaces not equipped with the vaporizer system will average from 0.5 to 0.6 gal. per square foot of jacket area exposed, per minute.

We are quite sure that the Consolidated Mining & Smelting Company officials at Tadanac will agree with us in the statement that they were not familiar with the Nesmith jacket-water vaporizer until it was suggested to them by Colorado Iron Works representatives, nor did they adopt it for an entire furnace until it had been successfully tried out on one jacket on an existing furnace. We furnished all of the original data and drawings from which the vaporizer system was adapted to the Tadanac furnace, and passed on the finished drawings of the No. 12 furnace before it was built.

We believe that the vaporizer system is an important factor in the success of the No. 12 furnace.

T. A. DICKSON
General Manager,
Colorado Iron Works Company.

Denver, Colo.

■

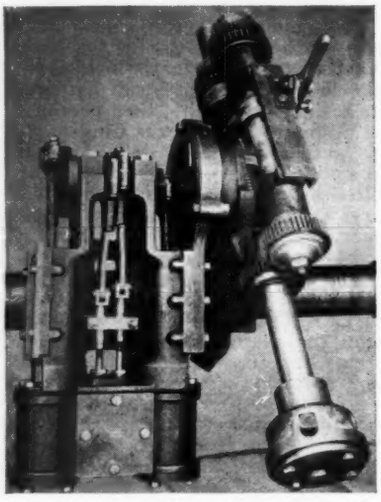
Obituary

Nelson Franklin, mining engineer, died on June 12, at his home in Washington, D. C., after a heart attack. He was a prospector in the early days of Colorado, and was later interested in several important developments in that state. He was 77 years old.

Albert E. Canfield, of Salt Lake City, Utah, died recently at his home there, after a long illness. Mr. Canfield was identified with several mining companies as director, and was for twenty years general manager of the Yankee Consolidated mine, at Eureka, from which post he retired about six years ago when that company was sold to the International Smelting Company.

INDUSTRIAL PROGRESS

Light, Easily Portable Diamond Drill Gives Good Results on Test



A diamond drill that weighs only 160 lb. This view shows front of two-cylinder air-driven engine

DEVELOPMENTS by the Mitchell Diamond Drill Contracting Company, San Francisco, Calif., of a "light" diamond drill that weighs only 160 lb. and will fit any standard rock-drill bar and clamp was reported in the Annual Review Number of this publication. This drill, it was reported, would take a 12/16-in. or $\frac{3}{4}$-in. core to 150 ft. Further facts regarding this unit are given in the following:

The drill is operated by a two-cylinder vertical compressed-air engine, the engine unit weighing 82 lb. Both the engine and the drill can be separately handled. The drill can be operated in a space 5 or 6 ft. in width and is designed for a drilling depth of 200 ft. Its principal use is for prospecting, determining the limits of ore masses and testing walls for parallel ore stringers. The company provides a bit-setting service for mining companies and sets such bits with carbon or bort. The charge for this service is nominal. The steel bits are heat-treated after setting, and this practice insures a more satisfactory performance. A standard ES core, $\frac{13}{16}$ in., is made. The complete rig is low in cost. A good drill operator can be trained in four or five days to operate the drill satisfactorily under ordinary conditions.

A number of mining companies have installed drills of this type. Core recoveries have usually been exceptionally high, 83 to 100 per cent, and operating costs range from 56c. to 88c. per foot. Costs for bit setting vary, but are approximately $44 for diamonds and $7.50 for the labor of setting. The drill has proved to be remarkably foolproof.

One company reports a hole 99 ft. in depth, drilled in 28 hours; 19 ft. in badly fractured and 79 ft. in slightly fractured quartzite; 40 per cent core recovery in badly fractured ground and 92.4 per cent in slightly fractured quartzite. The log kept showed in percentages of total time: set-up, 3.24; tearing down, 1.5; delays, 20.83; oiling and adjusting, 5.16; placing and adding rods, 4.08; removing core, 31.09 and drilling, 34.10. Costs were 57.7c. per foot. From another company's experience direct costs were 32.3c. and indirect 38c., or a total of 70.3c. per foot. Another company in drilling 1,105 ft. obtained a cost of 65.8c. per foot, of which 50.8c. was for labor; 10.9c. for diamonds, and 4c. for couplings, blank bits, and setting charges. At another mine, one hole, 39¾ ft., gave a drilling time of 10 hours 10 min. with 72.9 per cent core recovery; on another hole 54¾ ft. in hard quartzite the drilling time was 11 hours 45 min. with 79 per cent core recovery. Costs at this mine for a total footage of 158 ft. 10 in. were 79.6c. per foot. To date about twenty drills have been installed at different properties.

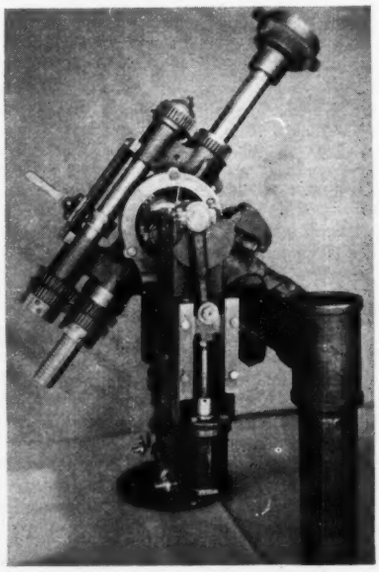
An extensive series of tests, one totaling 554 ft. of drilling, was conducted by the Britannia Mining & Smelting Company, Ltd., at Britannia Beach, B. C., under the direction of the Mitchell company's representative. The latter tests covered the five different formations found at the Britannia mine and are said by the mining company to have been very satisfactory with respect to ease of handling and total cost per foot drilled. A summary of the total footage drilled in five holes, ranging from 62 to 145 in. depth, and differing in angle, is given in Table I.

Table I—Diamond Drilling at Britannia Beach

Total footage, ft.	505
Total bort loss, Finehards at 6.25 per carat	13.23
Total bort loss (black reamers), carats	0.14
Total cost of bort loss	$97.19
Total cost of bort per foot drilled	0.19
Total cost of hole per foot drilled	0.88

The total cost per foot covers all costs of operation, including all loss of time, avoidable and otherwise. Data regarding drilling time and core recovery are given in Table II.

Demonstration tests were also made in syenite porphyry at Kirkland Lake, Ont., and in quartz porphyry, greenstone schists and free quartz at Porcupine, and in rhyolite and diabase in the Rouyn district. In these tests, drilling costs ranged from 53 to 82c. per foot, according to the Mitchell company, this including charges for stones, labor, and material. The stone loss is lowered proportionately to the reduction in the cutting area of the bit. Labor costs are reduced due to time saved in moving and setting up the machine. An inci-



The light diamond drill, mounted on a rock-drill bar, seen from one side

Table II—Drilling Time and Core Recovery at Britannia Beach

	Footage	Drilling Time Hr.	Footage per Bit	Per Cent Core Recovery	Geology
Hole No. 1, flat	106	40	18	85	Broken quartz, chert
Hole No. 2, 20 deg	145	43	26	67	Siliceous schist
Hole No. 3, flat	108	37	..	100	.....
Hole No. 4, flat	62	24	..	96	.....
Hole No. 5, flat	84	33	14	68	Siliceous schist

dent illustration of the drill's portability occurred at the Noranda Mines, when, in one 8-hour shift, the last 6 ft. of one hole was drilled, the machine moved, set up again, and 24 ft. of another hole drilled. The costs given are for two-man operation. The drill may be run by one man, if desired, it is said. Percentage of core recovered was high. The soft sericitic schists of the Porcupine district are said to have offered no obstacle to perfect recovery. As for drilling speed, the machine drilled the length of its 12-in. screw in 1½ min. in these schists. In the syenite porphyry of Kirkland Lake, however, this speed was reduced to 4½ min. for the 12 in. No slackening of speed was noticed under full load. Between Oct. 20 and Nov. 20 last, a total of 700 ft. was drilled in the three camps mentioned, the drilling taking nineteen days. Tests made under varying load factors showed an air consumption ranging from 60 cu.ft. per minute at 20 ft. depth to 75 cu.ft. at 135 ft. and deeper (full capacity). All readings were taken at 80-lb. pressure. Data regarding this work are given in Table III.

Table III—Diamond Drilling Data—Porcupine, Kirkland Lake and Rouyn—All Holes Flat

Test	No. of Holes	Depth, Ft.	Time, Hr.	Core Recovery, Per Cent	Diamond Loss, Carat	Cost of Diamond	Material	Labor	Total Cost	Cost per Foot	Geology
No. 1—Porcupine	1	149	56	95	2.5	$16.25	1.70	76.24	94.19	0.63	Quarts and silicified schist
No. 2—Porcupine	1	48	16	100	0.5	3.25	0.60	21.50	25.35	0.53	Sericitic schist, quartz stringers
No. 3—Porcupine	1	148	56	95	5.2	33.80	1.60	78.22	113.62	0.77	Quarts, schisted quarts porphyry
No. 4—Kirkland Lake	1	47.5	28	100	2.33	15.15	0.70	23.25	39.10	0.82	Syenite porphyry
No. 5—Noranda	2	298	128	100	14.50	94.25	1.75	142.00	238.00	0.798	Rhyolite, diabase
No. 6—Rouyn	4	527	118	100	7.30	50.70	3.75	240.59	296.04	0.56	Quarts porphyry, free quarts

In Test No. 4, the elapsed time of 28 hours included time for setting up, tearing down and moving to surface. Set up made in 5-ft. drift.

In Test No. 5, the total cost per foot of $0.798 is based on total elapsed time, which included 35.7 hours' delay caused by blasting in near-by mining operations.

Two sizes of core barrels are used with the drill. The so-called "light standard" drill uses an ES bit, which gives a $\frac{13}{16}$-in. core, and an E-rod diameter hole, which permits deepening the hole below the guaranteed capacity of 150 ft. by using E rods and a larger machine. The "light special" core barrel gives a ¾-in. core.

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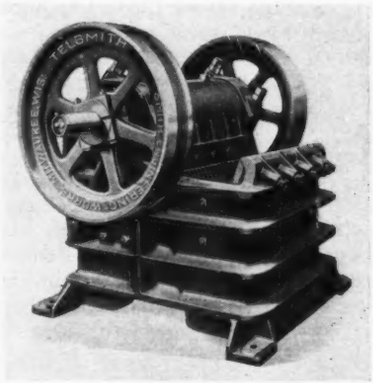
All-Steel Jaw Crusher of Improved Design

Portability Features Other New Equipment of Varied Kind—Dust Recovery Test Unit —Vibrating Screen Stabilized

NEW machinery and devices having application in mining and metallurgical work, or in work allied to it, continue to appear on the market in the usual variety. A brief summary is given in the following:

An Improved Jaw Crusher

Through purchase in 1930, the Smith Engineering Works, Milwaukee, acquired the crusher department of the Wheeling Mold & Foundry Company, including a line of steel jaw crushers equipped with anti-friction bearings. This crusher, which was featured by its simplicity, large feed area, compact steel structure, easy adjustment, and proved efficiency in fine reduction, was further improved by its new owners by certain important changes in the bearings, adjustment, jaw-clamping device, and the main structure. This improved model is called the Telsmith-Wheeling jaw crusher, which is quite different from the original, although strongly resembling it. It is shown in one of the illustrations presented herewith. The main structure of the frame is a strongly made boxlike casting of annealed cast steel. Both the wedge and toggle block slide on planed surfaces. The front end of the frame is machined to take the stationary jaw die and the frame is bored to assure true alignment of shaft and bearings. In this machine, the swinging jaw is of annealed cast steel with substantial vertical ribs. The eccentric shaft is of hammered carbon-vanadium steel. Messinger bearings, of the cylindrical roller type, are used in swinging jaw and frame. Jaw plates are



This all-steel jaw crusher embodies various improvements

of manganese steel and the dies are reversible. The crushing stroke is peculiar and is said to be particularly effective in producing the smaller sizes, from 1½ to ½ in. The size of the finished product is usually regulated by the adjusting wedge and the sliding toggle block. This adjustment can be made while the crusher is running.

Another Portable Hoist

A new size (HUL) has been added to its line of so-called "Utility" hoists by the Ingersoll-Rand Company, New York. This has a longer drum and a greater cable capacity than other hoists of this model, and will take 2,900 ft. of ¼-in. rope, 1,400 ft. of ⅜-in. or 800 ft. of ½-in. size. It will handle 2,000 lb. at 120 ft. per minute at 80-lb. air pressure. This rating is said to be conservative. The hoist may be used wherever a portable unit is needed, as in skidding and hoisting timbers, handling tools and supplies, moving and spotting cars. It is said to have a low air consumption and high over-all efficiency. The air motor is a reversible four-cylinder unit of radial-piston type and is accurately counterbalanced. Anti-friction bearings are used throughout. A jaw-type clutch and an external contracting type brake are provided.

Stabilizing the Vibrating Screen

A simplified mounting has been designed for its vibrator screen by the Stephens-Adamson Manufacturing Company, Aurora, Ill. Ordinarily, such screens are balanced upon springs which hold the screen body at the proper screening angle and yet are flexible enough to permit the screen to be given a vibrating motion. In the new mounting, the balancing springs have been replaced by a single mechanical unit called a "stabilizer," which is mounted on one side of the screen so that the screen body can vibrate freely with the drive shaft but cannot be rocked or bounced by sudden surges of feed. The mounting holds the screen at

Readily convertible excavator, of 1¼-1½-cu. yd. capacity and having wide range of application

a definite screening angle and offers no resistance to the vibrating action. The angle of the body may be changed by simply loosening two bolts. This is a simplification over the mounting requiring the adjustment of pressure on four springs. The stabilizer consists of two pairs of short cast-steel arms, each jointed in the middle and held parallel by a heavy cross bar. One end of each arm pivots on the flywheel housing, which is solidly mounted on the heavy steel subframe. The other end of each arm is free to move in a shackle on the screen body. The arms are free to swing or bend in any direction, but both must act together. Even in screens having a long throw, the movement of the stabilizer arms is so slight that there is practically no wear on parts. Arms and brackets are of cast steel and the hinge pins have Nathan automatic oil feeders which force oil under constant pressure to the moving surfaces, one filling often lasting for several weeks.

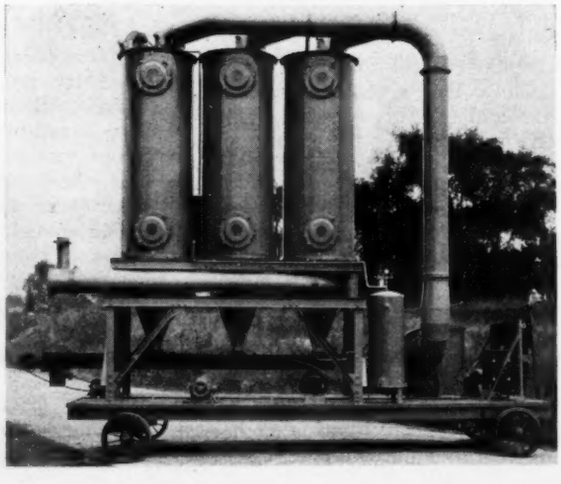
A Dust-recovery Test Unit

One of the illustrations here reproduced shows a completely self-contained, portable test unit recently shipped by the Dust Recovering & Conveying Company, Cleveland, Ohio, to the Mining & Smelting Trust of the Soviet Union. This equipment is intended to supply a reasonably large unit for testing dust and fume discharge at various points in the Smelting Trust's mining and smelting operations. A standard three-compartment filter is used to insure the accuracy of the results, inasmuch as a permanent installation would consist of virtually the same equipment. The dust-laden gas or air is drawn in through the inlet manifold at the left, which has a short vertical connection to admit atmospheric air for cooling where this is necessary. The cleaned air is exhausted through the fan and the solids are retained on the insides of the fabric tubes. The collected dust is precipitated regularly and is discharged through the screw conveyor to the outlet box in the lower left-hand corner.

Trolley Haulage Accessories

Because of demands brought about by greater developments in mine electrification, the Ohio Brass Company has made its Type C feeder insulator available in the two-spool design for accommodating 500,000-c.m. cable. In common with other models of this device, this insulator is suspended from the mine roof by a single expansion bolt. The steel yoke is of ample strength and the spools are of dense porcelain, these features insuring ability to withstand hard service over long periods of routine operation.

For welding, Ohio Brass has developed a 300-volt resistance welding machine to augment the usual 250-volt model. All features of previous machines have been retained. The new model is designed to deliver service under difficult mining conditions. Frequently cases are encountered in mining practice where the normal 250-volt trolley circuit is as high as 300 volts near substations and power houses. Bonding not uncommonly takes place within such zones of higher power, and repair shops where welding is done are often fed by this higher voltage.



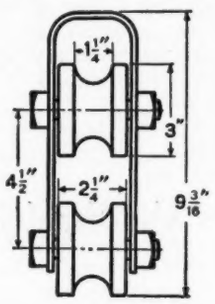
Completely self-contained portable test unit for dust-recovery work, recently shipped to Russia for Soviet Mining and Smelting Trust

Convertible Excavator Has Wide Application

A 1¼-1½-yd. excavator that is convertible to shovel, dragline, crane, or clamshell has been introduced by Bucyrus-Erie. This is the Model 37-B, which may be had with either Diesel, gasoline, or electric power, with rope or chain crowd on the shovel, and with regular or special extra long and wide mountings for work on soft ground with the dragline. Change from one type to another can be effected quickly.

Portable Loader Re-designed

After having improved its "Cub" portable loader from time to time over a period of years, the Link-Belt Company, Philadelphia, has completely redesigned it, retaining the name. The new model is lighter by 100 lb., but is said to be as strong and substantial as its predecessor. In addition, the conveyor, which is 21 ft. between centers, is equipped with an 18-in. belt, all-metal troughing rolls with roller bearings, bronze-bushed shaft bearings, a 9-in. head pulley which pulls without slipping, a ball-bearing motor, cut gears, and a short chain drive. Alemite lubrication is used throughout.



A two-spool feeder insulator for 500,000 c.m. cable

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INDUSTRIAL NOTES

American Askania Corporation has opened an office, with service facilities and displays, at 1603 South Michigan Ave., Chicago. In addition to industrial equipment, including all kinds of regulators for controlling plant conditions, it will handle its geophysical apparatus and other instruments hitherto distributed through its Houston (Texas) office. The latter office and the shop at that point will continue to be maintained.

Colvulc Rubber Company is the new name of the Hitchcock Company, Inc. The company's office has been moved to Norfolk Downs, Mass.

Geo. D. Whitcomb Company, Rochelle, Ill., has become a division of the Baldwin Locomotive Works, under the direction of Baldwin officials. It will operate as a self-contained unit as the Whitcomb Locomotive Company.

Great Western Electro-Chemical Company, of San Francisco, manufacturers of xanthate flotation reagents, has published its 1931 index of literature on the field of flotation.

NEWS OF THE INDUSTRY

C. & H. Officials Cleared in Cliff-Stock Suit Verdict

R. L. Agassiz and James MacNaughton, president and vice-president of Cliff Mining, as well as chairman of the board and president of Calumet & Hecla, largest Michigan copper producer, were cleared in a verdict made public by Judge C. H. Donahue, of the Massachusetts Superior Court, on June 11, covering a suit over sale of shares of Cliff Mining stock. Homer Goodwin, Boston broker, had brought the suit against the Cliff officials, charging that they had withheld information concerning the property which, if he had known it, would have prevented him from selling his 700 shares.

According to the suit, in March, 1926, Goodwin sold his Cliff stock under the impression that exploratory operations had been suspended at the mine, which is in the northern end of the Michigan district and which was one of the first producers there, having been operated in the 'forties of the nineteenth century. According to Judge Donahue's findings, Messrs. Agassiz and MacNaughton, as officers of the company, had obtained a geological report by T. M. Broderick early in 1926, that, while it could not definitely affirm the presence of copper in the property, gave encouragement for further exploration. As a result, the two officials placed an order to buy stock in the company for their personal account. Control of Cliff is held by Calumet & Hecla, of which they are also officers.

Since then, exploration of the Cliff mine has actually been resumed, being suspended early this year because of the depressed copper market. In the adjoining Phoenix property, work is being continued by Calumet & Hecla. Should it be successful, it will be carried into Cliff ground. In the meantime, however, those responsible for the management of the property have decided to conserve the limited funds in the Cliff treasury, particularly in view of the lack of success of the preliminary work.

According to Judge Clark's decision, " . . . there was no such fiduciary relation existing between Agassiz and MacNaughton and the plaintiff as to require them before purchasing his stock in the manner they did to make disclosure to him of the knowledge which they had and he did not."

■

U.V.X. to Close for Summer

United Verde Extension will close its mine, mill and smelter, at Clemenceau, Ariz., for ninety days, starting July 1. As United Verde Copper has already closed down, no properties in the Jerome district will remain in operation. (Verde Central has been closed since the summer of 1930.) The drop in the price of copper and the increase in stocks of refined copper are responsible for suspension of activities in the district.

Production of United Verde Extension has recently been about 3,000,000 lb. of copper monthly. In May it was 3,370,000 lb. Including custom ore, 1930 production was 22,500 short tons of copper, and 1929 production was 32,000 tons. The company has not found any new orebodies within the last few years, and present reserves are sufficient for only about two years of operation. Costs are low, compared with those of most Arizona producers. Before depreciation or depletion, but after crediting precious-metal revenue, the company could probably at least break even with present prices. The treasury is in a strong position.

■

C. & A. Still Has Vacancy

The meeting of the board of directors of Calumet & Arizona Mining on June 10 did not result in the election of a new president to succeed Gordon Campbell, who resigned at the annual meeting in April. No action was taken on the proposal to move the company's office from Calumet, Mich., to New York City—a proposal that was adopted at the annual meeting. Negotiations in connection with the Phelps Dodge merger continue, but no definite decision has been or is likely to be reached in the near future.

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Close Power Plant at Ray

In accordance with the curtailment plan of Nevada Consolidated Copper, operation of its steam-power plant, supplying power for the Ray mines and the company's concentrator at Hayden, Ariz., has been suspended, and a contract signed with the Salt River Valley Water Users' Association for the purchase of Coolidge Dam power. Power will be sold to the copper company for 5 mills per kilowatt-hour, delivered at Hayden, and 3½ mills per kilowatt-hour delivered at Ray.

■

U.S.S.R.&M. in North Carolina

United States Smelting, Refining & Mining has taken an option on gold properties, 5 miles from Charlotte, N. C. A two-year option has been obtained from Frank King, farmer, who owns the land on which the deposit is situated. Preliminary exploration work is now under way, under the direction of D. L. Martin. Several shallow shafts had been put down in previous efforts to develop this property. The district is reputed to have produced considerable gold. About a mile away from the King property is the Capp's Hill mine, with a reported output of $2,500,000 in gold, previous to its abandonment 25 years ago. U. S. Smelting has been active in prospecting the Appalachian area for the last two years, but reports of previous negotiations have all been denied by company officials. Through its subsidiary, Fairbanks Exploration, operating Alaskan placer deposits, the company is already one of the largest gold producers in the United States.

Start on Railroad Extension to New Mexico Potash Plant

Construction of a five-mile branch line from Loving, N. M., to the site of the proposed potash refinery of U. S. Potash, in Eddy County, has been started by the Atchison, Topeka & Santa Fe Railway. Permission to build the line was granted by the Interstate Commerce Commission on June 4. The refinery itself will be 16 miles from the mine shaft and will be connected to it by a narrow gage road which the mining company will build as soon as building material can be brought in. Cost of the Santa Fe extension alone will be $251,400, which the railroad company will pay. A bridge will have to be built across the Pecos River.

When operation is started, shipments by the mining company are expected to be 100,000 short tons of manure salts and 125,000 tons of refined potash the first year, according to the statements submitted to the Interstate Commerce Commission by the railroad. This will increase, according to the estimates, to a combined tonnage of 281,250 tons in the second year; 337,500 tons, the third year; 393,750 tons, the fourth year; and 450,000 tons, the fifth year, when the daily rate will be 1,500 tons. Annual domestic consumption of potash is about 270,000 tons. The railroad states that it anticipates a profitable volume of traffic for an indefinite period, as core tests in the area leased by the potash company indicate a potential body of 200,000,000 tons of silvite ore.

At present, U. S. Potash is trucking crude potash from the mine shaft over 22½ miles of graded dirt road and highway to Carlsbad, the nearest available railroad station. Loving is not now available because there is no bridge across the Pecos River. Shipments are expected to go to agricultural areas throughout the Southeast and Midwest.

Drilling in eastern New Mexico and western Texas has been carried on for several years by the U. S. Bureau of Mines with the object of determining the possibilities of establishing a domestic potash industry. U. S. Potash is probably the nearest to production of any of the companies operating in this field. At the annual meeting of Borax Consolidated, already an important producer of potash at its properties in California, the fact was revealed that this company, which is owned entirely by British capital, has a large interest in U. S. Potash.

■

Activity on Feather River, Calif.

At Oroville, Calif., dragline equipment is being installed to work submerged bars in the Feather River which were not accessible to the wing-dammers of former years. At the junction of the middle and south forks of the Feather River preparations are being made to wing-dam a portion of the channel. The low water prevailing makes such work feasible.

Copper Range Cuts Wages, Reduces Working Hours

Copper Range, operating the Champion and Baltic mines, near Painesdale, Houghton County, Mich., is putting its working force on the basis of a four-day week and is cutting wages 6 per cent. This compares with a 10 per cent cut made at the beginning of June by Calumet & Hecla Consolidated, largest operator in the district. Quincy also has reduced its wages, leaving only Mohawk Mining, among the Michigan producers, on the old wage scale. Mohawk is also operating nearest to capacity (although it is not converting concentrate into copper), its current rate being 70 to 80 per cent of capacity. Both Calumet & Hecla and Copper Range are now down to about 40 per cent of capacity.

Quincy, which had been gradually increasing production as its mine, reopened in 1929, was put in condition for large-scale operation, suspended all work for a period of three weeks on June 17. Evidently the company believes it more economical to run near its present normal basis when in operation and to close down for purposes of curtailing total output. Recently, the company has been producing 1,000,000 lb. of copper monthly, but selling little. Rental on company dwellings will be remitted during the suspension.

■

Jalisco Production Tax Dropped

Jalisco State government has indefinitely suspended the 2 per cent State mineral production tax, in an effort to induce various Jalisco mining companies to continue operations with full staffs. The companies informed the State and the Mexican Federal governments that it would be necessary for them to either suspend or greatly curtail their activities in view of depressed conditions in the industry. The Jalisco government announces that it will petition the Federal authorities to suspend the Federal mining production levy in respect to the Jalisco mines, in a further effort to make conditions easy for companies operating in that State.

■

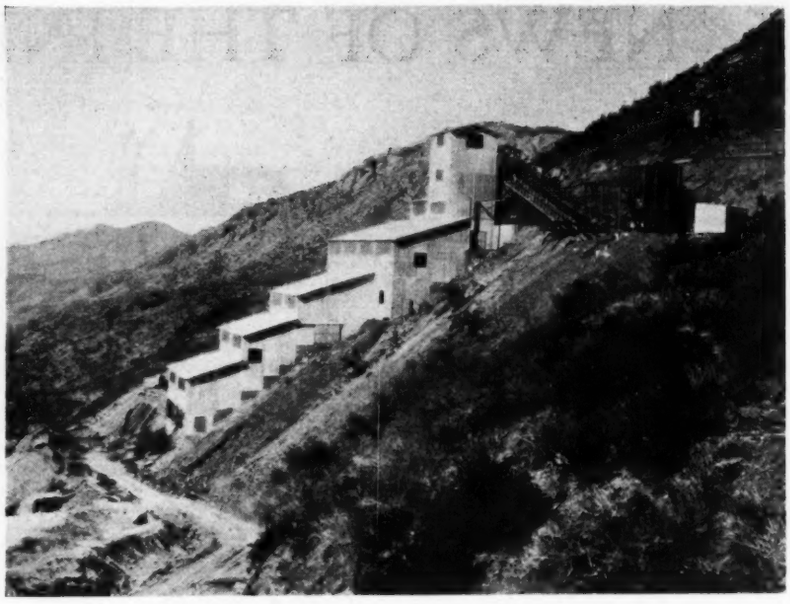
Graphite Strike in Sonora Mine

Development work is under way on a strike of graphite, reported to be high grade, in the Santa Edwiges mine, near Hermosillo, Sonora, Mexico. The property is owned by Luis R. Abitia. Where cut, the vein is said to be 1 m. wide. At last report, it had been followed for 36 m. and is believed to be continuous for about 200 m. additional in the direction of the Santa Maria de Lapiz mine, a graphite producer for the last 40 years. Mexico's annual production of graphite is about 5,800 metric tons.

■

Unemployed Prospect in California

Unemployment in California has resulted in emigration of many men, experienced and otherwise, to mineral areas, either to prospect or to placer creeks and stream beds. The total number of jobless men who are attempting to wrest a living in this way is unknown, but reports from different mining localities indicate a considerable amount of prospecting. The net result will be a greater knowledge of the potential possibilities of many of California's mining areas and the discovery of fresh deposits. Gold is the principal lure, but non-metallics are also sought.



The new 150-ton Boriana tungsten mill, near Yucca, Ariz.

Recover Copper and Tungsten at New Boriana Plant

Operation of the new Boriana flotation plant, of the Stoody Company, near Yucca, Ariz., which was recently started, involves the recovery of two concentrates—one a tungsten, and the other a copper concentrate carrying some gold. Capacity of the plant is 150 tons of ore daily. It was designed by Thor Relling and Prof. Frank Groch.

During the War, the Boriana mine produced about 30,000 tons of tungsten ore, which was milled in the district. The tungsten concentrate that was made contained a comparatively high copper content. Eventually the property was abandoned and the mill was dismantled because of failure to find a method to remove excess copper. In the spring of 1929 the deposit was acquired by the Stoody Company, of Whittier, Calif., manufacturers of hard-facing alloys. Since then, a long tunnel has been driven to develop the property, and reserves of ore have been developed.

Boriana mill makes a tungsten concentrate carrying less than 0.035 per cent copper and 0.75 per cent sulphur. The copper concentrate carries less than 0.1 per cent tungsten and, in addition, contains virtually the entire gold content of the ore. This copper product is reported to be of sufficient value to cover about half the operating costs of the property.

After reduction in a roll crusher, the ore is screened and oversize is returned to the finishing rolls. The undersize goes to two other screens, from which the oversize is sent to Deister tables. Undersize, which is minus-40 mesh, from the last screen goes through a series of Allen cones. Underflow from the cones is put through Deister-Overstrom diagonal-deck slime tables. Overflow from the cones goes to a Groch copper-flotation machine. The tailing from this machine goes to waste.

Table concentrate contains about one-third chalcopyrite, one-third pyrite, and the remainder, tungsten minerals. It is dewatered in an Allen cone and reground to 200 mesh in a ball mill, operating in closed circuit with a Dorr classifier. Overflow from this classifier is conditioned with flotation reagents in a Groch conditioner, before flowing to Groch flotation machines. Reagent feeding, both in the conditioner and in the flotation machine, must be regulated carefully, as a slight over-oiling may cause a loss of tungsten and an excess of tungsten in copper concentrate. Concentrates are filtered in an American filter and placed in bins for shipment. The property is about 18 miles from the Santa Fe railroad, at Yucca.

■

Vote Money to Michigan Tech. for Copper, Iron Research

The Michigan College of Mining and Technology at Houghton, Mich., will receive $50,000 a year for the next two years to continue research on copper and iron, the two outstanding mineral resources of northern Michigan. The State Legislature in recent session decided that the importance of this work justifies its continuance.

The geology department is cooperating with the Michigan Geological Survey in a study of the geology of the copper and iron ranges, and work already done has added important new knowledge to the geology of the copper and iron deposits. Detailed magnetic surveys are providing now information relating to the structure of the rocks in both the copper and iron districts. The department also cooperates with the metallurgy department in the study of low-grade iron ores to develop practicable methods of concentration.

In the chemistry department, studies are being conducted to check methods of determining copper analytically and possibly to develop a new method.

In the metallurgy department work has been done in studying the effect of impurities in copper on its conductivity and other physical properties. A study of sulphur in iron ores has endeavored to find some possible commercial method of eliminating at least a portion of it. In the study of low-grade iron ores, characteristics of the various types of ores are being determined, to provide information on which to consider the possible application of different methods of concentration.

The mining department is continuing its studies on methods of mining and on methods of timbering in use in the iron mines.

Beatty Says 8c. Copper Would Yield Mufulira a Profit

By Special Cable to "E.&M.J."

London, June 18.—At the annual meeting of Mufulira Copper Mines on June 15, A. Chester Beatty, chairman of the board of directors of the company, stated that present copper prices would yield a profit to the company on the basis of its initial plant capacity, 1,500 short tons of ore daily. (See p. 577, this issue, for details of the company's annual report.) On the day on which this statement was made, electrolytic copper sold in London at £38 a long ton and in New York at 7.825c. a pound, f.o.b. refinery. Costs for Roan Antelope, the first of the Northern Rhodesian copper mines to enter production, will be lower than estimated, he declared. Roan's costs have been put at 8c. a pound, exclusive of depreciation or interest, which will probably add from 1 to 2c. to this cost. (Interest alone is about 0.5c. a pound.) The first mill unit at Roan Antelope reached capacity operation, 1,000 tons daily, on May 31.

. . . . Luiri Gold, Northern Rhodesia's only gold producer, reports an output of £2,892 from 1,646 tons of ore in May. This is about the average of recent months. Rhodesia Broken Hill Development reports production of 1,015 long tons of electrolytic zinc and 18 long tons of 90 per cent vanadium pentoxide in the same month.

■

Ask Cut in Feldspar Tariff

The Tariff Commission announces that it has instituted investigations for the purposes of Section 336 of the Tariff Act of 1930, with respect to feldspar, crude and ground. The request for the investigation into crude feldspar comes from the Consolidated Feldspar Corporation, East Liverpool, Ohio, and asks a decrease in duty. All parties interested will be given opportunity to present evidence in the investigation to be held at the office of the Commission in Washington, D. C., or at such other place or places as the Commission may designate, on a date not yet fixed.

■

Bradshaw Output Rising

Production of gold by Bradshaw, Inc., from its tailing re-treatment operations in the Goldfield district of Nevada is now about $1,000 a day. The tailing that is being handled is from the old Goldfield Consolidated dumps and is being drawn at present from a low-grade section of the deposit. Recovery is not quite $1 per ton of tailing handled. Operation was resumed early in March, after the winter shutdown, and the output in the first ten weeks was $61,799. Because of curtailment by the copper producers, Bradshaw may become the second largest gold producer in Nevada this year.

■

Report Arkansas Lead Find

Kansas papers have carried a story within the last two or three weeks of a reported discovery of high-grade lead ore in a property, 22 miles southwest of Hot Springs, Ark. The discovery was made at a depth of 110 ft. by a group of Wichita (Kan.) men. The property itself has been worked for the last twenty years or so and adjoins land held jointly by Arkansas Mining & Development and Arkansas Manganese. These two companies are apparently controlled by the same interests. According to Ernest Garnett, of Amity, Ark., development will be suspended until a small mill has been installed.

■

Boulder Perseverance Not Yet Decided on New Plant

Boulder Perseverance, gold producer in the Kalgoorlie district of Western Australia, has not yet decided on construction of a new mill to replace the present plant. The company has been considering the matter for several years, but because of the high cost of mining machinery at Kalgoorlie, largely the result of the Australian tariff on equipment imports, and because of recent changes in gold metallurgy resulting from progress in the development of flotation, no decision has yet been reached. At the annual meeting in London on June 4, C. F. Bell, chairman of the board of directors of the company, asked for the support of the shareholders in financing a new plant. Without a new plant, he indicated, dividends may not be resumed.

Boulder Perseverance was organized in 1895 and has been one of the most consistent producers in the Kalgoorlie area. At present, its production fluctuates between 6,500 and 7,000 long tons of ore monthly, carrying about 9 dwt. in gold per ton. K. B. Edwards, director of the company, pointed out at the meeting that large tonnages of what is now junore are available that could be converted into profitable material if a new plant were available. This is particularly true in East Boundary Lode, where a large deposit has been opened between 1,100 and 1,750 ft.

■

Houghton County Pushes Road Building to Help Miners

In the Michigan copper district, where the mines have been compelled to lay off a considerable number of men because of the metal depression, the Houghton County board of supervisors has taken cognizance of the situation by voting to raise up to a maximum of $100,000 for road work. This will be in addition to the regular program of the Houghton County Road Commission. The county plans to provide work for able-bodied unemployed who are or may become dependent upon the county for support. Many who apply for assistance from the county are men who would rather accept employment than charity.

■

Celebrate Mesabi Discovery

On June 13 the discovery of iron ore on the Mesabi Range in 1889 was commemorated at Mountain Iron, Minn., by the erection of a huge granite boulder on the main street in front of the high school. To this boulder is attached a tablet giving the details of the discovery by the Merritt brothers. J. H. Hearding, assistant general manager of Oliver Iron Mining, of Duluth, who walked into Mountain Iron, years ago, was presiding officer of the Day. "Cap'n" John G. Cohoe, of Biloxi, Miss., who opened the mine, was present to give his personal recollections. The monument was unveiled by E. T. Merritt, of Duluth, and talks were given by William Culkin, secretary St. Louis Historical Society; George E. Wallace, of Minnesota Tax Commission, representing Governor Olson; John E. Merritt, of Aitken; Fred Siebert, of Mountain Iron, and Judge Hughes, of Hibbing.

Kirkland Lake at 4,750 Ft.; Lake Shore Shaft Progress

Kirkland Lake Gold, operating at Kirkland Lake, Ont., has bottomed its main winze at 4,750 ft. and Lake Shore, another Kirkland Lake producer, is nearly finished with the work of completing its No. 1 shaft to 2,975 ft. In addition, work is being started on the connection between the Kirkland Lake Gold and Teck-Hughes Gold properties at the 3,600 level that will provide an additional safety exit for operations at depth.

Crosscutting from the Kirkland Lake Gold winze will be undertaken on three levels—4,450, 4,600, and 4,750 ft. vertically below surface, the deepest workings in Canada. In view of the improvement in grade shown in the levels above, the management holds high hopes for the results of this development work. Kirkland Lake Gold output is now about $50,000 monthly, on ore averaging better than $12 a ton.

Lake Shore, which again surpassed Hollinger in the value of its production in the month of May, has six new levels to open between the 2,200 and 2,950 levels. In addition, a winze being put down 1,000 ft. west of No. 3 shaft is expected to be complete to 2,825 ft. by the end of July. Kirkland Lake, as a district, produced $1,865,241 in May, the highest production of the year and more than $400,000 higher than the output of Porcupine, formerly Ontario's leading gold district.

■

Sylvanite Exploration Showed New Sources of Ore

Work done during the year ended March 31 developed important new sources of ore, according to C. E. Rodgers, general manager of Sylvanite Gold, which operates a property adjoining Wright-Hargreaves, in the Kirkland Lake district, Ontario. Shaft sinking to 3,000 ft., now under way, will permit exploration of several new levels, regarding which sufficient exact information is not available to forecast results, although diamond drilling has shown vein indications in geologically favorable formation.

During the year under review, 5,911 ft. of drifting was completed, of which about 3,000 ft. was in ore. Aside from work in the more intensively explored areas in the No. 2 area, several hundred feet of drifting on the main south vein at 1,100 ft. showed a considerable tonnage averaging $6 a ton in gold over a width of 8 to 10 ft. Costs at Sylvanite per ton of ore milled were about $7.70 last year, indicating that the material is a little too low grade to be considered ore at present. In the north vein system, some high-grade ore was developed below the 1,000 level. Broken ore in the company's stopes is 67,772 short tons and on the surface, 6,528 tons, indicating a reserve equal almost to one year's supply for the mill. It is 22 per cent higher than at the end of the 1930 fiscal year.

■

Erno Bonds Property Near Redding

H. C. Erno has bonded the Potosi property, near Muletown, west of Redding, Calif., from Potosi Land & Mining. Payments will be made from proceeds. The area equals 40 acres, patented in 1875 and idle for many years.

Southwest Gets Natural Gas Ahead of Schedule

The new pipe line of the Western Gas Company from El Paso to Douglas and Bisbee, Ariz., and Cananea, Sonora, Mexico, via Deming, N. M., completed a 24-hour test and went into service on June 8, carrying natural gas from the Lea County gas field, in Texas. The new 12-in. welded pipe line, 294 miles long, brings to 518 miles the pipe lines now under operation by the El Paso Natural Gas Company and subsidiaries. The first plan called for completion by Aug. 1.

The possibility that the copper companies in the Southwest might contract for natural gas from Mid-West fields first became publicly known in May, 1930. At that time it was announced that Phelps Dodge had signed a contract and that Calumet & Arizona and the Arizona Edison Company, which supplies light and power for domestic use in southern Arizona, were also negotiating.

Natural gas is now used successfully in the El Paso copper and lead smelters and in the new Laredo antimony smelter, in Texas. C. & A. and Phelps Dodge operate copper smelters at Douglas, and Greene Cananea operates a smelter at Cananea. Oil has been the principal fuel used.

■

Mohawk Cuts Evergreen Lode at Depth in Michigan Mine

The crosscut from the No. 15 level of "E" shaft of the Mohawk Mining Company's Michigan mine, in Ontonagon County, has passed through the Evergreen lode, which is 42 ft. wide. The lode is phenomenally rich throughout in mass copper, but its true character cannot be determined until it is opened laterally for some distance. The ore in the crosscut may be only a pocket. The crosscut is being widened out preparatory to drifting. If mineralization persists in the Evergreen over a distance of several hundred feet, it will prove the lode. Opening work will continue as long as the ore lasts. If it pinches out within a short distance, the company intends to return to the Butler lode, which also was cut and found to be 64 ft. in width.

No ore was present in the Butler, yet the company feels that the Butler offers better possibilities than any of the other lodes of the Ontonagon series. This has been its history. Where the Butler is mineralized, shot copper predominates, as in other commercial lodes of the district. The Butler was located by the crosscut at the calculated distance from the shaft, but the Evergreen was cut 60 ft. short of the estimated distance. Drifting will determine whether the lode is in place.

The fact the Evergreen is of unusual richness at point of contact shows that there was deposition of copper in the area in which Michigan is working, and further investigation, it is believed, will uncover ore somewhere in the Ontonagon lode series.

This is the greatest depth at which the formation has ever been opened in "E" shaft territory. It is pioneer work in this respect, and definite geological data are the primary objects. If the lodes are found to be regular, without serious disturbance, they can be opened and developed at still greater depth.

At the Mohawk mine, in Keweenaw County, new openings in No. 6 shaft continue to show comparatively high-grade ore. Exhaustion of ore tributary to No. 1 shaft is imminent. This will leave only No. 6, which has a life of three or four years more. Mohawk is the only mine in the district working full time. Production is being maintained. Last year, No. 1 produced only 22 per cent of the total. Mohawk's costs are low. In 1930, mine costs were only 6.924c. per pound. Total cost per pound, including taxes, smelting, freight, marketing product, and Eastern office expense, was 8.724c. Costs this year should be somewhat lower on account of the reduction in wage schedule. Mohawk continues to store concentrate at the stamp mill, following a policy established last year, of holding its product for higher prices. A strong treasury is enabling it to continue this policy.

■

C.&H. Now at 50 Per Cent of 1930 Production

Now that the Osceola branch is closed down, Calumet & Hecla Consolidated, largest Michigan copper producer, is operating on a basis that is less than 50 per cent of last year's average monthly production. Total output of refined copper in 1930 was 105,740,000 lb. Osceola branch produced 16,051,000 and the Calumet and Tamarack reclamation plants, 17,842,000. Osceola and reclamation outputs are now shut off. The conglomerate and Kearsarge lode mines are on a four-day a week basis, compared with a six-day schedule in effect throughout the greater part of last year.

■

Alabama May Cut Iron-Ore Tax

The House of Representatives of the Alabama Legislature has passed a bill calling for a reduction of the tax on iron-ore production from 4.5c. to 1.5c. a ton over a period of several years. This action was taken to help mining companies in the Birmingham district, which have been hard hit by the depression. Accorting to Representative West, who sponsored the reduction, the taxes were adopted in 1919 as emergency measures, but have since been retained.

■

Moscow Developing 900 Level

Three excellent showings of ore are being followed from the 900 level of the Moscow Mines in the Star district near Milford, Utah, according to Garratt Wilkin, manager of the property. One of these is a pipe of high-grade ore, 30 in. wide, carrying a high-grade lead carbonate ore. This showing occurs in the Glory fissure. It is making up toward the soluble limestones and should lead, according to Mr. Wilkin, to a body of replacement ore. Ore is being taken out in two other places on the 900. One is on the east side of the main drift on an extension of a shoot from which a carload was mined recently. The other is on the west side of the main drift on an extension of the same shoot to the west. Farther west on the same fissure is a third stope directly above the Fault stope. In this area, there is a large quantity of iron with small streaks and bunches of higher grade material scattered through it. This stope, measuring about 100 ft. long, is not being worked at present, since the others are productive of a more marketable type of ore with present metal prices.

Two A.S.&R. Lead Smelters to Close for Summer

American Smelting & Refining, largest lead-smelting organization in the world, will close its plants at East Helena, Mont., and Murray, Utah, during the months of July, August, and September. These two smelters, handling ore from the entire Inter-Mountain territory, have been forced to take this step because of the curtailment in production of lead ore and concentrate in Utah and Idaho districts, where the bulk of their supply is obtained. Although the smelters will be closed, arrangements are being made to maintain the ore-buying departments throughout the period, so that mines still in operation can ship their products. Evidently the management feels that it would be uneconomical to continue operations at present reduced rates, in view of the low price of lead, and that a preferable policy is to accumulate large stockpiles which can be worked off by operation at normal rates during the fall.

The official company statement, released to the press, said: "Operations necessarily must be curtailed at some time. The company therefore has decided to close down during the Summer months of July, August and September its lead smelters at Murray, Utah, and East Helena, Mont. It will carry on the business of purchasing and receiving such ores as mines may ship during the shutdown. This shut-down will enable its labor to seek employment elsewhere during the Summer months, and to return at the beginning of October, at which time smelters will resume operations on a larger scale, and afford steadier employment than would otherwise be possible."

The Murray lead smelter has a larger capacity than any other plant in the country, maximum effective capacity of its eight furnaces being 2,400 tons daily. Ore is shipped to it chiefly from the Tintic, Bingham, and Park City lead districts, but some custom material from mines in neighboring states is obtained. The East Helena plant treats the concentrate output of Federal Mining & Smelting, second largest Coeur d'Alene lead producer, in which A.S.&R. has a large interest. It also handles byproduct lead-bearing materials from the Anaconda copper and zinc plants. The most recent figures available indicate the two plants employ an aggregate of 950 men, but during the depression this probably has been much lower.

■

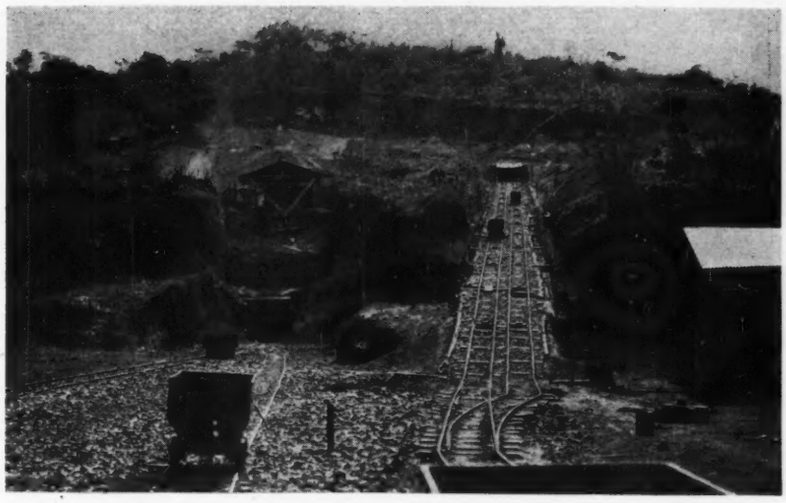
Utah Bunker Hill Cuts Lead Ore

A showing of lead-silver ore has been struck in the Utah Bunker Hill mine in the Stansbury Mountain district, west of Grantsville, Utah, at a point 500 ft. from the portal of the main tunnel. The company has drifted a short distance in the ore.

■

Search for Gold at Lime Point, Nev.

Development is being carried on at two points at Lime Point, Nev., now called Golden, by Trinity Mining and by Lee Lakin to prove a sufficient tonnage of low-grade gold ore to justify milling operations. Trinity Mining, under the direction of H. M. Gilbert, has advanced a tunnel 125 ft. Mr. Lakin has done considerable churn drilling by hand.



The Kanga lode mine of Kilo Moto Gold, in the Belgian Congo. The company is producing 420 kg. of gold monthly.

Panama Starts Remance Mill

The Panama Corporation announces that the new 100-ton plant at Remance, Panama, has been fully tested and is now running with gradually increasing tonnage. The average grade of the ore sent to the mill is about 40s. in gold per ton. This ore will be treated together with a limited amount of ore averaging 4 to 5 oz. per ton from the northern section. The second gravel elevator has started working at Sabalo. At El Mineral, production from the Gold tunnel with one monitor started on May 14. Development is reported to show an average grade of 3.8s. in gold per cubic yard.

■

Central Eureka's 1930 Results

Central Eureka Mining, operating at Sutter Creek, Calif., reports for the year 1930 a total tonnage milled of 54,026 tons, averaging $6.90 in gold per ton, from which the recovery was $6.12 per ton. Gold bullion and concentrates totaled $330,690. Ore extracted from the Central Eureka mine was 18,753 tons and from the Old Eureka mine, 35,348 tons. Crosscuts, drifts, and raises aggregated 2,943 ft. Development of new oreshoots continues to be an interesting feature of current operations.

■

Parkhill Mill Ready to Start

Construction of the 75-ton cyanide plant at the Parkhill Gold property, near Wawa, in Michipicoten, northern Ontario, has been completed, and the plant is ready to start operations. According to George Glendenning, a director of the company, reserves include 30,000 short tons of ore averaging $20 a ton in gold and 25,000 tons of $10 ore above the 240 level. Sinking of the shaft to 600 ft. may yield sufficiently encouraging development results to warrant raising mill capacity to 125 tons daily by the addition of a tube mill. About $250,000 has been spent in developing this property, which now becomes the third gold mine outside the Porcupine and Kirkland Lake districts to enter production. The other two—Howey and Minto—have also started work since the beginning of 1930.

Siscoe to Build Tramway

Siscoe Gold Mines, leading gold producer in northwestern Quebec, will build a wire-rope tramway to connect its main shaft and mill. The shaft has just been completed to a depth of 600 ft. Crosscutting to the west ore zone will be undertaken at once. Most of the ore is coming from this zone on the 300 and 450 levels. At present, the mill is handling about 160 short tons of ore averaging $12 per ton in gold daily. In April, when output was the highest in the mine's history, production was $65,798, but May production was probably not more than $60,000. Costs are between $5.50 and $6 a ton, according to J. T. Tebbutt, president. If ore development at depth maintains expectations, mill capacity may be doubled. An eventual tonnage of 500 daily has been envisaged for the property. A new bunk house is being built to house the additional men required for the expansion program. The property is in Dubuisson Township.

■

Reopen Virginia Gold Mine

Work of rehabilitating the old workings in the Waller gold property, at Tabscott, Goochland County, Va., has been under way for several months. According to reports, an expenditure of $250,000 will be made in developing the property by Leo Faust. Estimates of production from this property, which was in operation early in the nineteenth century, run as high as $2,000,000 in gold. Development of new ground is expected to start within a few weeks, when the rehabilitation is complete.

■

Install Equipment at Los Lugos

Machinery for the mine and mill of Los Lugos Consolidated Gold is arriving at the property, in southern Zacatecas, near Guadalajara, Mexico, according to a statement made by S. J. Wilson, president of the company, at the annual meeting in Spokane, Wash., on June 9. Operation of the mill was scheduled to start on Aug. 15. Flotation equipment will be used. Herbert Stanton, of San Francisco, and L. R. Budrow, of San Diego, Calif., have been added to the board of directors.

Mufulira Reports Reserves of 6,706,800 Tons of Copper

The first annual report of Mufulira Copper Mines, Ltd., covers the period from the formation of the company, Feb. 3, 1930, to Dec. 31, 1930. Originally formed to acquire the Mufulira special mining grant of 9,344 acres, including the Mufulira mine, this company on Nov. 30, 1930, took over all the remaining properties of Rhodesian Selection Trust, Ltd., consisting of 21 special mining grants in the N'Kana Concession. The consideration was £399,-613 10s. These acquisitions gave Mufulira Copper Mines, Ltd., with its original holdings, ownership of 149,684 acres of mineral ground.

In point of unmined reserves proved, Mufulira is now exceeded in size only by Chile, Kennecott, and Rhokana Corporation. Its engineers estimate its ore reserves at the end of 1930 as follows: Mufulira mine, 116,000,000 short tons, averaging 4.41 per cent; Chambishi, 25,000,000 tons averaging 3.46 per cent, and Baluba, 21,-000,000 tons averaging 3.47 per cent, the total being 162,000,000 tons, averaging 4.14 per cent copper. These ore reserves contain 6,706,800 short tons of copper, 96 per cent of which is in sulphide minerals. Though Mufulira has only about one-fourth as many tons of ore as Utah Copper, Kennecott subsidiary, the amount of metal in the reserves of these two companies is very nearly the same.

Mufulira's issued capital was recently stated to be owned in approximately the following proportions: Rhodesian Selection Trust, Ltd., 64 per cent; Rhokana Corporation, Ltd., 32 per cent; and British South Africa Company, 4 per cent. These companies are financing its development and equipment. The first unit of the plant, 1,500 tons of ore daily capacity, is in course of construction, with a good prospect that it will be completed by the end of this year or soon after. It will be added to later and brought up to a capacity of 2,000,000 tons of ore yearly.

Included in the Chambishi ore reserves are 3,000,000 tons averaging 8.95 per cent copper. Negotiations with Rhodesia Railways for construction of a railroad from Chambishi to Mufulira are on the point of completion. The object of this line is to make Chambishi's high-grade ore available for treatment in the Mufulira mill. By an issue of 50,000 of its shares, Mufulira has purchased from the British South Africa Company a release from its obligation to carry out prospecting work on the special grant areas, and is thus in a position to devote its attention and funds exclusively to the development and equipment of its mines.

■

Comstock Mine Changes Hands

Union Consolidated Mining has granted a six months' option on its Union property, on the Comstock Lode, near Virginia City, Nev., to H. C. Carlisle, San Francisco mining engineer, and associates. At present, the crosscut on the 1,600 level is being put into condition for operations. When this work is completed, diamond drilling may be undertaken. Charles Mayotte is in charge at the property.

Union Consolidated is also negotiating for the transfer or lease of its property in Calaveras County, Calif. The company states that it lacks the funds to proceed with development of this property, as the workings are now down to 300 ft. and further exploration at greater depth would require a safety exit.

Drilling Indicates New Ore on Indian Copper Area

Diamond drilling of the Dhobani deposit, about a mile west of the Mosaboni mine, in the Singhbhum district of Bengal, Chota Nagpur, India, has cut an orebody that is considered by officials of Indian Copper to show exceptional promise, fully justifying underground development. The three holes put down, at intervals of 300 to 400 ft. apart on the strike of the formation, cut lode matter at depths varying between 120 and 130 ft. The lode averaged 5 ft. wide and carried ore averaging 4.98 per cent copper. Holes were at right angles to the dip of about 60 per cent. The Dhobani deposit is included in the same mining lease as the Mosaboni mine and could be worked economically in conjunction with that mine. Old workings show the lode to be at least 1,500 ft. wide. The mine superintendent estimates the ore indicated by the drilling at 75,000 short tons.

Development done in the Mosaboni mine during 1930 was limited, according to the annual report of the company, because reserves at the end of 1929 were considered ample. Recently, however, sinking from the No. 5 level has been resumed. Two winzes are being put down on the dip of the lode to what will be the No. 6 level, 200 ft. below. In addition, Nos. 2 and 3 level drifts have both been continued south, toward a series of ancient surface pits, with encouraging results. At the end of 1930, ore reserves were 697,146 short tons, averaging 3.208 per cent copper. This is about a five-year supply of ore at the present rate of operations—12,000 short tons of ore monthly.

At the metallurgical plants, recovery of copper in concentrate increased from 95.73 per cent in 1929 to 96.72 per cent in 1930. A 4-ft. Symons cone crusher has been added to the coarse-crushing equipment. In the smelter, the two old barrel-type converters have been replaced by two new 8-ft. Great Falls type converters, from which improved results have been obtained. The new rolling mill, which handles production from the refinery, has been gradually operated up to capacity. The company states that "a ready market exists locally for a quantity far in excess of the present capacity of the plant." Present capacity is 3,000 long tons of yellow metal sheet annually. Refinery capacity is more than 4,000 long tons. Virtually the entire production, both of refined copper and of sheet metal, can be sold in India.

■

Gold Strike in Vanadium Mine

A strike of high-grade gold ore is reported to have been made on the 125 level of the United Vanadium property at Dripping Springs, Ariz., according to G. Naddeo, general superintendent. Three recent assays made by O. J. Tuschka, of Old Dominion, at Globe, showed gold contents of $244.66, $29.20, and $305.47 a ton. The ore is being taken from a distinct 2-ft. ledge believed to be a continuation of the one found in the Old Cowboy mine, about 1 mile distant. At present, United Vanadium is employing 40 men six days a week. Future development work and plant improvements contemplated include sinking of a 210-ft. shaft and installation of a 60-hp. compressor, a complete blacksmith shop, and 2 miles of pipe, in addition to other equipment purchased from the Copper Reef mine.

The Mongbwalu placers of Kilo Moto Gold, in the Belgian Congo. Placers produce about two-thirds of the company's output.

Unofficial Silver Conference a Possibility; Japanese Government States Opposition

Efforts to secure an international conference by interested governments to stabilize the price of silver having apparently failed, as the result of opposition from several countries, notably Great Britain, friends of the white metal are turning to the International Chamber of Commerce for aid. It was this organization that, at its May meeting in Washington, D. C., came out in favor of an international conference on silver. Another meeting of the International Chamber will be held in Paris in July, and an effort will be made there to have an unofficial international conference called to develop means of improving and stabilizing silver prices.

On June 11, the Associated Press reported that Ambassador Debuchi of Japan, in Washington, had been instructed by his government to inform the United States government it has definitely decided not to take the initiative in the promotion of an international silver conference. The reason given was that the "situation might be aggravated in case of failure."

President Hoover's message to Senator Smoot, quoted in the June 8 issue of *E.&M.J.*, which indicated that an international conference would not be held at present, has resulted in arousing the opposition of Senator Pittman, of Nevada, now in China, studying the silver situation, and Senator King, of Utah. Senator Pittman stated that he expected a conference on silver within three months, and that, when it started, Great Britain and France would be represented.

Senators Smoot and King presented their views on the silver situation before a luncheon of the Salt Lake Stock & Mining Exchange early in June. Senator Smoot said that an official conference was impossible, but that an unofficial conference might do some good. Senator King took issue with him and declared that the inclusion of Great Britain in an official confeernce was not impossible. He contended that the problem of silver must be solved by governments. Since then, Senator King has been in Washington and New York, conferring with government officials and with J. P. Darling, director of the Midland Bank of London and a stout advocate of silver stabilization. In a statement made in Washington on June 13, Senator King reiterated his belief that Great Britain would attend a conference, were President Hoover to call one, despite its present opposition. "In my opinion," he stated, "Great Britain is the greatest offender in the sinister work of debasing silver and riveting monometallism upon the people."

■

U.S.S.R. Puts New Iron Mine in Production in Urals

On May 15, according to the Chamber of Commerce of the U.S.S.R., production was started at the Mount Magnitnaya iron-ore mine, in the Ural Mountains, Russia. This work is part of the Magnitogorsk iron-and-steel development scheme. Production of ore will gradually be increased to about 200,000 metric tons monthly, with prospects of still further increases in the future. The deposits are estimated to contain 300,000,000 tons of ore averaging 70 per cent iron content, according to the Chamber. Although their existence has been known for 180 years, they had not previously been exploited.

■

Sink New Winze at Bodie

At Bodie, Calif., Treadwell Yukon has made preparations to sink a 100-ft. winze from the 800 level of the Red Cloud shaft. Changes are being made in the company's gold flotation mill. Its stamp mill is being steadily operated on ore from the Red Cloud-Noonday area.

BRIEF NOTES

A.S.&R. Denies Concheno Deal. A report from Durango, Mexico, which appeared in the Los Angeles *Times* of June 8, to the effect that American Smelting & Refining has taken over the Concheno gold-silver properties, in western Chihuahua, has been branded as absolutely without foundation by the New York office of A.S.&R. The Concheno properties referred to are probably those operated by Dolores Esperanza in 1928-30, 75 miles south of Dolores. The drop in the price of silver forced their closing last spring. No new developments have occurred at the A.S.&R. Mexican properties recently, operations being confined to routine work during the present period of depression.

Ashanti Ore Rich at Depth. Development on the No. 26 level, the deepest in the Ashanti Goldfields property, near Obuassi, Gold Coast, Africa, has cut ore 13 ft. wide, assaying 19.7 dwt. in gold per ton, in the No. 6 NE crosscut. Previous crosscuts to the vein at this depth had shown low-grade material, averaging about 2 dwt. in gold per ton over the entire vein width. This condition had been expected close to the shaft, as it is similar to the ground developed on Nos. 24 and 25 levels. The No. 6 crosscut confirms the continuation of rich ore at depth, however. On the Côte d'Or reef, a crosscut southwest of the shaft, No. 7, on the No. 18 level, struck 12 ft. averaging 16.5 dwt. per ton in gold. In May, the company produced 14,222 oz. of gold from 12,063 short tons of ore—a grade not equaled in any gold mine of like size now operating anywhere. The operating profit was £41,910 and the net profit, £35,219.

Consolidated Gold Reopens Mine. Operation of the company's Lexington mine, at Oatman, Ariz., has been resumed, according to T. A. Wood, president. New hoisting and mining equipment has been installed and the shaft will be re-timbered. The property shipped a small tonnage of gold ore to the Tom Reed mill several years ago. Development has been carried to a depth of 350 ft.

Consolidated Mayflower Milling Ore. A small tonnage of gold ore from the Starlight incline shaft is being put through the mill at Pioneer, Nev. The company plans to connect the Starlight No. 2 tunnel with these shaft workings. This will eliminate hoisting, as well as the haul from the collar of the shaft to the mill. At present, trucks are used to carry the ore. By using No. 2 tunnel, a tramway built from the portal to the mill several years ago can be utilized. Leasers on the property are contributing some mill tonnage.

Delaware Mines Wins Suit. A decision in the Idaho district court has upheld the officers and directors of Delaware Mines in the organization of Associated Mines, an affiliated corporation, to which all the assets and stock of Delaware Mines have been transferred. L. E. Whicher, vice-president of United Verde Extension and a large stockholder in Delaware Mines, brought suit against the company, contesting the legality of the reorganization. Delaware Mines stock was not assessable, whereas Associated Mines is. The property, better known as the Rex and Red Monarch groups, is in the Coeur d'Alene district of Idaho.

Discovery Mine Reopened. The famous old Discovery mine, near Galena, Kan., is being operated by a grandson of John McAllen, who discovered the mine in 1877. Some new oreshoots are reported to have been developed. Production is estimated at $5,000,000 in lead and zinc since it was first worked.

Golconda Ore Widens. The new ore, developed east of the fault, on the 1,400 level of the Golconda Lead property, in the Coeur d'Alene district of Idaho, has widened to 7 ft., of which 3 ft. is high-grade ore, according to local reports. West of the fault, ore has been proved for 900 ft. in length, with a width of 8 to 9 ft. Crosscutting to the east of the fault was at first unsuccessful, but a diamond-drill hole, put down to the southeast, indicated the presence of ore. Crosscutting followed, and, at last report, the ore had been followed for a distance of 55 ft. W. A. Beaudry estimates that the entire 7-ft. width will average 12 per cent lead—or better than the mine average. About 600 ft. of additional ground to the east can be explored before the boundary line of the Square Deal property is reached. Golconda has an option on a 50 per cent interest in the latter property.

Gold Hill Output Steady. Production from the new cyanide plant of Gold Hill Development, near Round Mountain, Nev., was $21,180 in May, $22,300 in April, and $22,080 in March. Recovery in the first half of May was slightly below normal, because low-grade ore from the 400 level was handled. The drift on the 400 has now passed through this area.

Golden Center to Reopen. The property, at Grass Valley, Calif., which is controlled by Cooley Butler, will be reopened, according to local reports. It has been worked several times in the past and is credited with a production of about $1,000,000 in gold. An incline shaft has been put down to 1,860 ft.

Golden West May Build Mill. Development of the Golden West property, near Libby, Mont., has indicated gold ore in two tunnels, according to Henry McCullough, of Spokane, Wash. Consideration is now being given to construction of a milling plant, as the small shipments that have been made to date have had to be of high grade to meet transportation charges. A highway has recently been built to the property from the main road, about 3½ miles away. N. C. Sheridan, formerly interested in the Golconda mine, in the Coeur d'Alene district, is in charge.

Goldsmith Dredging to Start. Men and supplies are on the way to the property, 10 miles from Nome, Alaska, under the direction of C. B. White. Dredging is expected to start about July 1 and to continue for three and a half months to Oct. 15. The company's dredge can handle 3,000 cu.yd. daily, but the actual yardage put through at first will be only about 60 per cent of capacity.

Jack Waite Completes Raise. The raise at the property in the Coeur d'Alene district of Idaho that has been driven to connect the Montana and Idaho tunnels has been completed. This raise is about 520 ft. along the dip of the vein, which has been drifted on in both tunnels. The vertical distance between the levels is about 400 ft. In the Idaho, or main, tunnel high-grade ore has been followed for 400 ft., with a thickness varying from 5 to 12 ft. In the Montana tunnel, ore has been followed for 350 ft., but the width is considerably less. The raise has proved the continuity of the ore between the two tunnels. In addition, a shaft is being put down in ore from the Idaho tunnel which adds about 100 ft. to the vertical extent of the ore deposit. After a recent visit to the property, Stewart Campbell, state mine inspector, stated that he saw more high-grade ore in the Jack Waite property than he had seen in any other Coeur d'Alene property, with the possible exception of some of the old and larger producing mines.

Lincoln Mining to Resume. Development of the company's property, adjoining that of Sunshine Mining, near Osburn, in the Coeur d'Alene district of Idaho, is to be resumed, according to statements made at the annual meeting, early in June. The main crosscut will be extended to the Sunshine vein, a distance of about 450 ft. In addition, the drift on the Lincoln vein, showing ore in places, will be continued east and a raise will be put up to the surface to provide ventilation. The company is issuing 2,000 shares of preferred stock, carrying 8 per cent, at a par of $10, to help finance development.

Naumkeag May Sell Mine. Naumkeag Copper, holding 1,200 acres west of Houghton, Mich., on the south shore of Portage Lake, will hold a meeting on June 23 to consider sale of the property to Copper Range, which holds adjoining property to the south. Acquisition of Naumkeag will extend considerably Copper Range holdings on the Ashbed and Atlantic lodes. Development on the Naumkeag property was suspended in 1920, after about $250,000 had been spent without indicating any extensive copper deposits. Control is held by the Lewisohn interests.

Nevada-Montana Lays Pipe Line. The pipe line for the property at Placeritos, Nev., has been virtually completed. It is a 5-in. line, tapering to 2-in., and is fed from two storage tanks with a combined capacity of 42,000 gal. The company controls 4,000 acres of placer ground and expects to keep costs down to 25c. a cubic yard.

Roros Copper to Be Remodeled. The Norwegian government has appropriated 550,000 kr. (about $150,000) for modernization of the Roros copper plants. These properties are operated by the government and include a small smelter, with two blast furnaces and a converter.

Tonopah Divide Leasers Ship. A 4-ton lot of ore, said to average better than $1 a pound in gold and silver, has been delivered to the American Smelting & Refining plant at Selby, Calif., from the Anderson-Williamson lease in the Tonopah Divide property, near Tonopah, Nev. The shipment was made by truck, because of the high grade of the ore. In addition, milling ore from the property is being shipped to the Tonopah Mining plant at Millers, Nev.

U. S. Copper Case Appealed. United States Copper, which operates properties in New Mexico, has appealed to the Supreme Court of the State a decision in the suit brought against it by several stockholders. The case, started in April, 1929, seeks to cancel certain shares of stock claimed by J. W. McAlpine and to declare null and void an election of officers and directors of the company, held in March, 1928. The decision in the lower court was in favor of the plaintiff. Records of the hearings have now been filed with the Supreme Court, but probably several months must elapse before a decision is made.

Wiluna Gold Makes Profit in Third Month of Operation

By Cable to "E.&M.J."

London, June 16.—Wiluna Gold, the new gold producer near Meekatharra, Western Australia, reports a working surplus of £4,570 in May. Plant operation was started only in March and the first clean-up was effected in April. Production in May was £30,200 in gold, including the premium on exchange. This was recovered from the treatment of 22,086 long tons. In April, production was £19,133 from 18,025 long tons. In addition, the company estimates that in April the plant absorbed £7,620 in gold and in May, £1,200. Plant capacity is 40,000 long tons. Estimates of operating costs are 19s. 9d. per ton and development and mine-preparation costs, 3s. 6d., making an over-all cost at the property of 23s. 3d. Average grade of ore reserves is between 35 and 40s.

. . . . Tin producers in the Federated Malay States, confronted with the problem of putting the new restriction agreement on production into effect, have decided to treat the first six months under which the agreement is operative (the six months ending Aug. 31) as one period. In this period, production will be 75 per cent of the 1929 output, or about the rate called for by the first agreement, adopted last February. After August, the full restriction required by the new plan adopted in May will apply. Malayan output will be about 65 per cent of the 1929 total. This means that individual mines will operate at about 68 per cent of their 1929 outputs, the remaining 3 per cent being accounted for by the mines that have closed down.

. . . . Fabulosa Mines Consolidated, British-controlled Bolivian tin producer, reports a production in 1930 of 1,139 long tons of fine tin, or slightly less than the 1929 output. The average cost of production was £132 1s. 11d. per ton of tin. A net loss of 254,235 bolivars was suffered in 1930. At the end of the year, ore reserves were 169,200 metric tons, containing 3,950 tons of tin. This compares with reserves of 131,405 tons, containing 3,318 tons, at the end of 1929. The company holds three groups of mines, north of La Paz.

. . . . Beralt Tin & Wolfram, which operates properties in Beira Baixa, Portugal, reports that exploitation in its Serra property is developing orebodies, carrying the average grade of tin-wolfram ore, sufficient to provide its mill with tonnage for many years. The company has a 120-ton mill and produced, in 1930, the first year of regular operation, 276 long tons of wolfram and 42 tons of tin.

. . . . Mawchi Mines, which operates tin-wolfram properties in the Karenni State of Bawlake, Burma, is reorganizing its capital structure. At present the capacity consists of £300,000 in ordinary shares of £1 each. Of these, 173,316 shares are issued and fully paid and 113,471 have been under option at par. The new scheme provides for cancellation of 16s. of the par value of the outstanding stock, thus bringing its value down to 4s. each. The unissued 126,684 shares will be subdivided into 4s. shares, making a total of 633,420 unissued and 173,316 outstanding. An additional 693,264 shares will be created, making the capitalization 1,500,000 shares of 4s. par. Milling at the property was resumed in February, 1930, and to the end of the year, production totaled 2,018 long tons of tin-wolfram concentrates.

. . . . At Mount Isa Mines, in northern Queensland, Australia, two of the three mill units are now in operation, treating 1,400 long tons of silver-lead ore daily. One blast furnace in the smelter, started on June 8, is now running in a satisfactory manner and is producing metal.

. . . . Sir Evelyn A. Wallers, chairman of the board of directors of Cape Asbestos, reports that because of the contraction in the demand for asbestos, production at the Amosite asbestos mines, in the Lydenburg district, Transvaal, has been curtailed. The new plant is not working at its full capacity. Competition of cheap Russian products is affecting the trade, Sir Evelyn stated. The outlook of the company is uncertain, but its financial position is considered strong.

. . . . The first consignment of copper from the mines in Central Africa has arrived at Lobito Bay, in Portuguese West Africa, on the Atlantic Coast. Union Minière, the big Belgian Congo producer, has made an agreement with the Benguela railroad to ship at least 4,000 tons of blister copper and matte monthly by this route, which saves about 3,000 miles in shipments to the European market.

■

Safety Winners at Washington

Representatives of four of the mines which won the 1930 safety competition were received by President Hoover on June 8, and later were guests at a luncheon at the National Press Club. A. B. Jessup, vice-president of the Tomhicken Anthracite Mine, at Jeddo, Pa., operated by Coxe Bros. & Company, Inc., represented that property. The winning bituminous mine, Penn Central No. 1 at Coalmont, Pa., owned by the Penn Central Light & Power Company, was represented by J. A. Shearer. By a coincidence, the metal-mine prize and the quarry prize went to properties of Pickands, Mather & Company. They were the West Vulcan iron mine at Vulcan, Mich., and Plymouth Mining, at Wakefield, Mich. These properties were represented at the conference with the President and at the luncheon at the National Press Club by W. A. Chinn. The non-metallic prize was won by the Lower Gypsum Mine of the U. S. Gypsum Company, at Gypsum, Ohio. The representative of that company was unable to attend the President's conference and the luncheon, however, because of illness.

■

Gold Ledge Buys Mariposa Mines

Gold Ledge Mining has acquired gold-mining properties in Mariposa County, Calif., of which the most important is the Feliciana. A winze will be sunk from the 400 level of this property, which is equipped and has been under development for several years.

Assay Office Established in New Sinaloa Placer Area

For the purpose of acquiring all gold produced at the new placer workings of Cerro de Tambor, San Ignacio Municipality, Sinaloa, Mexico, the Banco de Mexico, the republic's only bank of issue, has established a field office there, staffed by an inspector and an assayer. The bank explains that this action is to afford Tambor miners a chance to sell their gold at just prices, instead of marketing the metal at low rates to buyers who sell it abroad, especially in the United States, at high profits.

The bank has made contracts with the largest group of Tambor miners for all the gold they extract. This means that the institution will acquire almost all the yellow metal Tambor produces. This gold will be brought to Mexico City and immediately sent to the national mint here. This coinage, the bank says, will relieve the prevailing shortage of gold money in the country.

Discovery of the Tambor deposits caused considerable excitement earlier in the year. See *E.&M.J.* of April 13 and 27 for details.

■

Lower Costs Extending Life of Lonely Reef Gold

At the annual meeting of Lonely Reef Gold, in London, F. C. Rowsell stated that the estimated life of the mine, near Bulawayo, Rhodesia, is about seven years. No new sources of ore supply have been discovered, but the lowering of working costs by 7s. 3d. to 23s. per ton allows the inclusion, in the reserves, of large quantities of material which formerly was unpayable. Every 2s. reduction in expenses enables the management to lower the limit of payability by 0.5 dwt. Production in 1930 was 45,957 oz. of gold from the treatment of 71,900 tons of ore and 183,900 tons of tailing.

■

East Geduld to Start Soon

At the annual meeting of Union Corporation, held in London early in June, the statement was made by P. M. Anderson, chairman of the board of directors of East Geduld, that production will be started at the company's new mill on the Far East Rand, Transvaal, about the middle of July. This will be the first addition to the ranks of Rand producers in several years. East Geduld has a capacity to handle 60,000 short tons of ore monthly. Dividend payments, Mr. Anderson stated, should begin in June, 1932. Union Corporation has a large interest in East Geduld.

■

Protest Mexican Labor Law

The mining industry is cited as an example of depressed economic conditions in Mexico in a petition submitted to the national Congress by groups of employers' organizations, protesting enactment of the pending new labor laws. The petition avers that last year more than twenty important mines suspended, and that the mining industry alone has contributed 28,000 to Mexico's army of unemployed. The petitioners predict dire things for Mexico if the law is approved in its present form. At the same time, workers' organizations are asking for a six-hour day to reduce unemployment.

MARKET AND FINANCIAL NEWS

Domestic Zinc Production Curtailed in May

The zinc statistics for May, released early in June by the American Zinc Institute, revealed a sharp decline in domestic production, the daily rate for the month being 829 tons, against 971 tons in April, 1,043 tons in March, and 1,481 tons in May of last year. Owing to further contraction in demand, shipments for May totaling 25,851 tons, a new monthly low for the movement, stocks of zinc at the end of the month showed but little change.

The figures for April and May, in tons, follow:

	April	May
Production	29,137	25,688
Production, daily average	971	829
Shipments	27,418	(a) 25,851
Stock, end of month	143,212	143,049
Retorts operating end of month	29,072	23,024
Retorts operating, average for month	29,165	23,032
Unfilled orders	36,150	31,146

(a) Includes 20 tons exported during the month. There were no exports in April.

■

International Commerce Body Plans Silver Parley

The International Chamber of Commerce, at a meeting to be held in Paris in July, will take steps to call an unofficial international conference to develop means of improving and stabilizing the price of silver. At its meeting in May the organization adopted a resolution favoring the holding of such a conference this year. As efforts to bring about an official international conference of the principal nations of the world have apparently failed, it is reported that an unofficial conference will be held under auspices of the commerce organization with a view to recommending remedial measures to the governments concerned

■

U. S. Copper Consumption Declined in 1930

Copper withdrawn for domestic account during 1930 totaled 1,265,016,702 lb., according to the U. S. Bureau of Mines. This compares with 1,778,585,415 lb. in 1929. The decrease naturally reflects the general decline in industrial activity.

The new refined copper withdrawn from the total year's supply on domestic account in the United States in 1930 and the method employed in determining this movement are shown in the following table, which, however, does not include stocks of copper held by consumers:

New Refined Copper Withdrawn From Year's Supply

	1929	1930
Total supply of new copper	2,874,127,168	2,243,269,509
Stock at beginning of year	114,000,000	306,000,000
Total available supply	2,988,127,168	2,549,269,509
Copper exported (a)	903,541,753	669,252,807
Stock at end of the year	306,000,000	615,000,000
	1,209,541,753	1,284,252,807
Withdrawn on domestic account	1,778,585,415	1,265,016,702

(a) Includes refined copper in ingots, bars, rods, or other forms.

■

United States Lead Output Increased During May

Production of lead in the United States during May from domestic ore amounted to 39,519 tons, against 35,498 tons in April, and 52,818 tons in May, 1930, according to the American Bureau of Metal Statistics. Shipments showed a moderate drop for the month, with the net result that stocks again increased.

United States Lead Statistics

In Short Tons

Production:	April	May
From domestic ore	35,498	39,519
Secondary and foreign	2,941	3,598
Totals	38,439	43,117
Stock at beginning (a)	130,426	133,457
Total supply	168,865	176,574
Stock at end (a)	133,457	142,370
Shipments by difference	35,408	34,204
Shipments reported	35,324	34,081

(a) Domestic only.

Mexico's April Production of Silver Increased

Production of practically all metals in Mexico during April was greater than during the previous month, according to estimates made by the Mexican Bureau of National Statistics. The Bureau values the April output, in round figures, at 19,162,000 pesos and the March production at 16,588,000 pesos.

Official comparative figures for the two months are:

In kilograms

	March	April
Gold	1,488	2,007
Silver	202,477	295,782
Copper	4,428,342	5,636,777
Lead	28,260,502	23,090,004
Zinc	8,858,745	12,579,496
Antimony	512,723	644,847
Graphite	215,582	299,946
Mercury	20,681	29,580
Arsenic	633,905	472,226
Tin	31,666	48,741

Translated into ounces, Mexican silver production in April was roughly 10,500,000 oz., compared with 7,135,000 oz. in March.

■

Canadian Metal Production

Production of metals and minerals in Canada during February and March of this year, according to the Dominion Bureau of Statistics, follows:

	February, 1931	March, 1931
Asbestos, tons	13,147	13,114
Copper, lb.	22,970,724	25,508,733
Feldspar, tons	377	800
Gold, oz.	195,118	203,818
Gypsum, tons	19,162	10,828
Lead, lb.	19,326,869	27,650,026
Nickel, lb.	6,693,185	8,358,289
Silver, oz.	2,111,765	1,886,652
Zinc, lb.	20,553,489	23,297,788

Refined Copper Production of the World

(American Bureau of Metal Statistics)

In Short Tons

	1929			1930		
	Primary	Secondary (b)	Total	Primary	Secondary (b)	Total
United States	1,376,112	166,126	1,542,238	1,097,611	136,021	1,233,632
Canada	2,913	.....	2,913	31,347	.....	31,347
Chile	266,706	.....	266,706	194,391	.....	194,391
Germany	114,199	17,416	131,615	114,088	28,770	142,858
Other Europe	174,787(a)	37,772	212,559	178,497(a)	37,440	215,937
Orient	76,821	8,200	85,021	82,254	9,000	91,254
Africa	14,335(a)	.....	14,335	14,815(a)	.....	14,815
Australia	12,179	.....	12,179	14,394	.....	14,394
Total	2,038,052	229,514	2,267,566	1,727,397	211,231	1,938,628
Electrolytic	.....	.....	1,974,256			1,680,798
All other	.....	.....	293,310			257,830
Total	.....	.....	2,267,566			1,938,628
Mine production	2,127,100			1,750,000		

(a) African electrolytic production included with Europe.
(b) Includes production from scrap by primary producers only.

Additional Curtailment in European Zinc Output

INTERNATIONAL METAL SERVICE, LTD.
LONDON

The fact that zinc has been selling at a level that is bound to have the effect of bringing about further general curtailment in output has made operators rather cautious in making commitments on the bear side of the market. Much of the recent pressure resulted from realizing by smelters in need of cash. Current prices of ore and metal hardly permit of hedging operations. The weakness in other metals has had a depressing influence on zinc.

Though stocks of zinc, taking the world as a whole, again increased in the last month, the trend of events is certainly beginning to favor the statistical position. With the shutting down of the Swansea Vale smelter on June 1, the British output of metal is reduced to negligible proportions; Germany will be forced to turn out even less than the meager figure reported for April, and the Polish Giesche company is planning a drastic reduction in production. The trade is looking for some distinct signs that the overseas output is going to be similarly kept in check. At the moment any decline in European output is being fully counterbalanced by the arrivals of metal from Canada and Australia.

Consumption of zinc remains disappointing in nearly all quarters. Inquiry for galvanized sheets from India has led to some hope for an expansion in business, but this has not yet materialized into anything tangible. Both the rolling mills and brass works are operating well below normal. Russia has taken up some tonnage during May, which should reduce surplus stocks now held in Poland.

With adequate control of production apparently out of the question, quite a few observers feel that a period of extremely low prices should do much to correct the situation. Zinc at £10 per ton for a month or more, it is held, would be followed by the closing down of smelters that have been hesitant about taking this step. Those favoring drastic action to cure the ills of the industry believe that once plants are shut down, resumption of operations would hardly take place before zinc is again selling at £17.

World stocks of slab zinc at the end of May, in metric tons, follow:

	Metric Tons
United States	129,800
Canada, including afloat	30,500
Australia, including afloat	19,500
Germany-Poland	20,600
Belgium	15,700
France	15,700
Great Britain	16,800
Other Europe	10,000
Far East	6,000
Elsewhere	4,000
Total	258,600

Estimated stocks of zinc at the end of April amounted to 254,900 metric tons. At the end of March the stocks were 251,000 metric tons.

Statistics on world production of zinc released on June 17 estimated the output for May at 86,227 tons, against 89,637 tons in April, and 97,539 tons in March. Most of the reduction in output took place in the United States, though declines were registered by Poland, Germany, and Great Britain.

A movement is on foot to revive the European zinc cartel, and negotiations are to be resumed in July, according to a report from Brussels.

■

Trading in Silver Futures Initiated in New York

Trading in silver futures was initiated on the National Metal Exchange, New York, June 15. Sales for the day involved 1,525,000 oz., or 61 contracts of 25,000 oz. each. Interest centered chiefly in the August and December positions, though all months up to next May were posted by the exchange. Prices quoted ranged from 26.82c. per oz. for August, to 27.05c for May delivery.

Prior to the opening of the new market, attended by more than 100 guests and representatives of brokerage houses, addresses were made by Ivan Reitler, president of the National Metal Exchange; Parker Willis, economist and professor of banking at Columbia University, and Congressman Loring Black.

■

Financial Notes

PENARROYA, European lead-zinc-silver producer, reports a net profit of 21,697,852 French francs in 1930, compared with 32,936,856 fr. in 1929. The company has declared a dividend for the year of 30 fr., before tax payments, per share of stock, compared with 45 fr. in 1929. Fixed assets at the close of the year were 326,334,337 fr., representing properties and investments, and 266,248,526 fr. in liquid assets. Current liabilities totaled 240,242,741 fr. The company's 6 per cent notes outstanding were 166,272,189 fr. at the end of the year, compared with 212,658,700 fr. at the beginning. Reserves total 46,774,769 fr.

ALASKA JUNEAU in May, 1931, reports 352,270 tons mined and trammed to mill from which estimated results were as follows: Operating revenue, $338,500, or 96.09c. per ton; operating expenses, $194,000, or 55.07c. per ton; operating profit, $144,500, or 41.02c. per ton. Interest on current funds less Ebner and outside prospecting costs brought the surplus for the month to $145,400.

■

Smelter Production of Copper According to States

Output of copper in the United States, produced by smelters from domestic ores, decreased about 30 per cent during 1930, according to the U. S. Bureau of Mines.

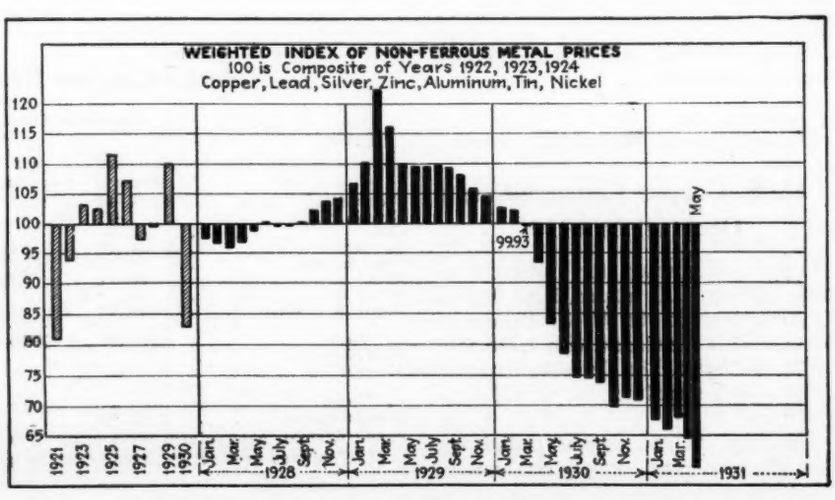
In the following table the production is apportioned to the states in which the copper was mined. The figures represent the content of copper in the blister produced, the smelter output of ingot, and anode copper from Michigan:

Copper Produced from Domestic Ores

(Smelter Output in Pounds)

State	1929	1930
Alaska	39,867,940	36,380,038
Arizona	829,206,475	570,897,080
California	33,084,232	26,262,447
Colorado	10,519,784	12,943,857
Idaho	6,267,487	2,713,681
Michigan	185,300,917	142,985,522
Missouri	1,880	2,198
Montana	299,894,853	198,795,883
Nevada	138,990,247	87,475,019
New Mexico	100,165,206	74,187,966
North Carolina	(a)	(a)
Oregon	739,151	229,753
Pennsylvania	3,581,393	3,061,174
Tennessee	(a)	(a)
Texas	393,740	165,731
Utah	325,965,289	205,769,698
Vermont	752,200	(a)
Washington	1,569,260	1,404,893
Wyoming	4,305	29,356
Undistributed	26,558,776	31,085,031
Totals	2,002,863,135	1,394,389,327

(a) Included under undistributed. U. S. Bureau of mines not at liberty to publish.



Refined Copper Stocks Increased in May

Stocks of refined copper in North and South America at the end of May amounted to 398,667 tons, an increase of 30,746 tons over the total for the preceding month. The stocks in the hands of producers are the largest on record, and contrast with 373,609 tons in April, 1921, the previous high. Stocks of blister, however, continue to fall, a reduction of 3,298 tons bringing the total down to 190,578 tons. The increase in stocks again resulted from a decline in domestic and export shipments.

Summary of Copper Statistics

In Tons of 2,000 Pounds

Production:	April	May
Mines, United States	46,452	45,671
Blister, North America (a)	65,509	66,812
Blister, South America (a)	24,613	24,812
Refined, No. & So. America	100,501	102,695
World, blister basis	128,677	.....
Stocks (end of month):		
No. and So. America:		
Blister (b)	193,876	190,578
Refined	367,921	398,667
Totals	561,797	589,245
Great Britain (c)		
Refined	12,784	15,163
Other forms	1,564	1,374
Totals	14,348	16,537
Havre	8,646	11,045

(a) Includes direct-cathode copper. (b) Includes in process. (c) Official warehouses only

U. S. Mine Production

	April	May
Porphyry mines	18,514	18,836
Lake mines	5,229	4,727
Vein mines	19,740	19,408
Custom ores	2,969	(a) 2,700
Total crude production	46,452	45,671
Daily rate	1,548	1,473

(a) Partly estimated.

Smelter Production

	April	May
United States	52,085	53,734
Canada	9,625	9,000
Mexico	3,799	4,078
Totals	65,509	66,812

Shipments

	North and South America		
	Export	Domestic	Total
1926	525,861	902,174	1,428,035
1927	641,865	824,844	1,466,709
1928	674,221	983,460	1,657,681
1929	586,594	1,119,409	1,706,003
1930			
January	30,358	69,932	100,290
February	29,597	61,879	91,476
March	30,523	73,644	104,167
April	29,196	50,017	79,213
May	49,115	75,760	124,875
June	44,818	71,887	116,705
July	42,466	75,436	117,902
August	38,319	56,810	95,129
September	37,873	65,169	103,042
October	38,246	75,703	113,949
November	45,051	62,693	107,744
December	39,169	69,854	109,023
Total	454,731	808,784	1,263,515
1931			
January	45,597	60,209	105,806
February	39,415	60,636	100,051
March	36,797	74,685	111,482
April	32,218	54,567	86,785
May	26,684	45,265	71,949

■

U. S. Quicksilver Imports

Imports of quicksilver during April were nil. Imports in the first four months of the current year amounted to 15,645 lb., valued at $21,229, against 120,145 lb., valued at $161,528, in the same period last year.

■

Dividend Changes

The continuation of low metal prices has resulted in numerous changes in dividend rates by prominent non-ferrous metal producing companies. Kennecott Copper, the leading producer in the Hayden - Jackling - Guggenheim group, has cut its dividend rate from 50c. to 25c. quarterly, effective with the payment to be made on July 1, to stockholders of record June 11. Utah Copper, most important of the Kennecott subsidiaries, has lowered its rate to $1.50 quarterly, compared with $2 paid in the previous quarter. The Utah payment falls due on June 30. Nevada Consolidated, in which Utah has a 43 per cent interest, maintains its dividend at 25c. quarterly, payable June 30.

United Verde Extension, independent Arizona copper producer, has declared a 25c. quarterly payment for its August dividend, compared with the former rate of 50c. quarterly. Bunker Hill & Sullivan, largest Idaho lead producer, paid its 25c. regular monthly dividend for the common stock on June 5, but has suspended future payments until an upward turn in lead occurs. The company has not been earning its dividend since March. Consolidated Mining & Smelting, British Columbia's largest lead-zinc property, is paying $1.25 in cash and one share for every twenty shares held in stock for the six months ending June 30. This compares with former semi-annual payments of $6.25 in cash. Payment will be made July 15.

American Smelting & Refining will pay a quarterly dividend of 50c. a share on Aug. 1, compared with the rate of $1 quarterly that has been maintained since the stock was split, three new shares for one share of old, in 1929. Newmont Mining, perhaps the best known of mine-finance companies in the United States, passed its quarterly dividend, due in August. Payment has been at the rate of $1 quarterly for several years. Howe Sound, which cut its dividend from $1 quarterly to 75c. last quarter, has cut it again, and will pay only 50c. on July 15.

■

Berlin Sales Agency

Metallzentrale G. m. b. H. has been organized in Berlin, Germany, with a capital of 200,000 marks. The company plans to deal in copper, lead, and other non-ferrous metals, under the directorship of Carl Sussman, brother of Otto Sussman, president of the American Metal Company, Ltd.

Transportation Leads as Aluminum Consumer

The transportation industry was the largest single consumer of aluminum in 1930, the percentage absorbed in this field being about the same as in the preceding year.

Despite the fact that the volume of building in the United States during 1930 showed a substantial decrease, contrasted with the record for 1929, the proportion of aluminum consumed in that division actually increased. The sale of architectural aluminum increased more than fivefold. As a result of this gain the building industry now takes about 4 per cent of the total aluminum sales, against 3 per cent in 1929.

Completion of several high-power transmission lines last year resulted in a good market for aluminum in the electrical field. At present, about 365,000 miles of aluminum cable are in use in the United States. Aluminum cable is used chiefly on lines transmitting high voltages over long distances. Aluminum cable, usually constructed with a steel core, possesses greater bulk than copper to convey a given current, owing to the difference in conductivity of the two metals. This feature is of value in reducing corona loss.

During 1930, the use of aluminum in the production of cooking utensils declined about 2 per cent.

Distribution of aluminum during 1930, by industries, based on sales by the Aluminum Company of America, follows:

	Per Cent
Transportation (air, land and water)	38
Electric conductor	16
Cooking untensils	14
Machinery and electrical appliances	9
Iron and steel metallurgy	8
Building	4
Miscellaneous foundry and metal working	4
Chemical	2
Food products	1
General miscellaneous	4
Total	100

■

German Copper Imports Up in First Quarter

In the first quarter of 1931 Germany imported 45,665 metric tons of copper, against 32,113 metric tons in the same period last year. German imports in the January-March period in 1930 and 1931, by countries, in metric tons, follow:

	January-March	
	1930	1931
United Kingdom	137	50
United States	11,335	14,253
Belgium	4,429	7,767
Belgian Congo	126	5,919
Sweden	612	836
Holland	12	47
Spain	1,380	636
Czechoslovakia	1,570	509
Yugoslavia	3,105	3,670
Chile	3,505	5,431
Canada	1,200	40
Port. East Africa	434	2,783
Totals	32,113	45,665

Canadian Nickel Production 103,768,857 Lb. in 1930

Finally revised statistics on nickel production in Canada during 1930, as reported by the Dominion Bureau of Statistics, show an output of 103,768,857 lb., valued at $24,455,133, compared with 110,275,912 lb., valued at $27,115,461, in 1929. These figures include the nickel in matte exported by the International Nickel Company of Canada, Ltd., and Falconbridge Nickel Mines, Ltd., valued at 18c. per pound; refined and electrolytic nickel produced by the International Nickel Company valued at the average price obtained for such products sold during the year; nickel in nickel oxides and nickel salts sold from the Deloro and Port Colborne metallurgical plants at its total selling value as oxides or salts; nickel contained in speiss residues exported valued at 18c. per pound, and a small amount of nickel contained in ore exported from a prospect in the Timagami forest reserve of Ontario.

The greater part of the world's nickel supply comes from the mines located along the rim of the norite-micropegmatite eruptive of the Sudbury basin area in Ontario. Two companies have reduction plants in this district. The International Nickel Company of Canada, Ltd., operates smelters at Copper Cliff and Coniston, and the Falconbridge Nickel Mines, Ltd., smelts nickeliferous ores at its property a few miles east of the town of Sudbury. Nickel is also recovered in smaller quantities from silver-cobalt-nickel ores of Ontario by the Deloro Smelting & Refining Company, Deloro, Ontario.

■

Distribute Cosach Shares to Anglo-Chilean Holders

Distribution of shares in Cosach, the new Chilean nitrate trust, to stockholders in Anglo-Chilean Consolidated, the largest of the individual units to enter this trust, will be made on the following basis, according to an official announcement by W. E. Bennett:

"At a special meeting of the stockholders of the corporation, held on April 17, 1931, a plan of reorganization of the corporation with Compañia de Salitre de Chile (hereinafter referred to as Cosach) was approved. Pursuant thereto all of the business and substantially all of the assets of the corporation have been transferred to Compañia Salitrera Anglo-Chilena, a Chilean corporation, and there have been delivered to the corporation 8,318,335 Series B ordinary shares of Cosach.

"There is now distributable to the stockholders of the corporation, pro rata in accordance with their respective holdings and without the surrender of their stock, 7,027,000 Series B ordinary shares of Cosach. The corporation will retain for the time being the remainder of the 8,318,335 Series B ordinary shares of Cosach received by it pursuant to the reorganization (that is, 1,291,335 shares), together with the indebtedness not assumed by the Compañia Salitrera Anglo-Chilena or Cosach, which indebtedness totals $2,661,039.75, exclusive of interest.

"Notice is hereby given that, pursuant to order of the board of directors, in order to determine the stockholders of the corporation entitled to receive distribution of such 7,027,000 shares of Series B ordinary shares of Cosach (such distribution being at the rate of four shares of Cosach for each share of the Corporation), the stock transfer books of the Corporation will be closed at the close of business on June 18, 1931, and will remain closed for a period of twenty days, reopening at the beginning of business on July 9, 1931. Stockholders of record at the close of business on June 18, 1931, will be entitled to receive their pro rata distribution of such 7,027,000 Series B ordinary shares of Cosach, at the above rate. Certificates representing such shares of Cosach will be mailed on June 30, 1931, or as soon thereafter as may be practicable, to the stockholders of the corporation of record at the close of business on June 18, 1931.

"It is contemplated that during the period of twenty days above referred to the stock of the corporation will be withdrawn from listing, and the Series B ordinary shares of Cosach will be listed on the New York Curb.

"The principal office of Cosach is at 620 Calle Prat, Valparaiso, Chile. The undersigned (W. E. Bennett) an assistant secretary of Cosach, has an office at Room 3518, 120 Broadway, New York City. D. A. Crockett, New York transfer agent of Cosach, has an office at Room 3605, 120 Broadway, New York City."

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Mexican Production of Lead, Zinc, and Copper

Production of copper, lead, and zinc in Mexico during the last twenty years, in metric tons, according to data compiled by the Mexican Bureau of National Statistics, follows:

In Metric Tons

Year	Copper	Lead	Zinc
1910	48,160	124,292	1,833
1911	56,072	116,758	1,593
1912	57,244	105,160	1,266
1913	52,592	68,343	960
1914	26,622	19,971	792
1915	22,206	5,703	5,806
1916	28,411	19,971	37,449
1917	50,986	64,125	45,181
1918	70,223	98,837	20,699
1919	52,172	71,258	11,560
1920	49,192	32,513	15,651
1921	15,228	60,513	1,257
1922	26,978	110,456	6,142
1923	53,372	155,720	18,481
1924	49,112	164,140	18,936
1925	51,336	171,767	45,770
1926	53,763	210,794	105,366
1927	58,734	243,346	136,478
1928	65,506	236,486	161,747
1929	86,492	248,501	174,030
1930	73,412	232,931	124,084

Canadian Production of Metals in Platinum Group

Revised statistics on the output of the metals of the platinum group, as reported by the Dominion Bureau of Statistics at Ottawa, show that 68,116 oz. of platinum, palladium, rhodium, and other metals, valued at $2,439,128, were produced from Canadian sources in 1930, against a total of 29,837 oz. of these metals, worth $1,656,045, in 1929.

Imports of platinum, including manufactures thereof, and palladium, iridium, osmium, ruthenium, and rhodium were valued at $122,851, compared with $211,906 in 1929. During the year 19,835 oz. of platinum contained in concentrates and 285 oz. of scrap were exported, a total of 20,120 oz., valued at $1,626,598, against 2,910 oz., valued at $225,519, in 1929.

Production of Canadian platinum metals comes almost wholly from the copper-nickel sulphide ores of the Sudbury area. The International Nickel Company is now operating a modern precious metal refinery at Acton, England. In this plant concentrates containing metals of the platinum group, produced at Port Colborne, Ontario, and Clydach, Wales, from the Frood and Garson ores, are treated. This refinery is equipped to refine approximately 300,000 oz. of high purity platinum metals a year at extremely low costs.

In British Columbia, platinum occurs erratically in the placer deposits of the Tulameen and Quesnel rivers. Small amounts of crude platinum have also been obtained on the Findlay river. The Consolidated Mining and Smelting Company, Ltd., is the sole producer of palladium in the province. This metal, together with a small amount of platinum, is recovered in the Trail metallurgical works.

■

Diamond Agreement Reached

An agreement has been reached among South African producers for control of the market for diamonds, according to advices received from Cape Town. The quota system in force last year will be maintained practically unaltered. The Diamond Corporation is to take over from the syndicate the purchases from all sources, and agrees to acquire, during the next year, diamonds up to the value of £1,400,000.

■

Michigan Copper Shipments

Copper shipments by boat out of the Michigan district in May were light, only 4,054,000 lb. being moved. Most of this was Calumet & Hecla metal. Small rail shipments are being made from time to time. The bulk of the copper, however, is shipped by water during the season of navigation.

Copper Offered Freely on 8c. Basis—Active Call for Lead—Platinum Advanced

New York, June 18, 1931.—The copper statistics for May exerted an unsettling influence on the market. Buying for foreign and domestic account was in fair volume early in the period and seemed to steady prices, but an increase of more than 30,000 tons in stocks of refined metal caused buyers to again restrict business and the metal was available in virtually all directions on the basis of 8c. per pound. In the week that ended yesterday, lead sales approached 9,000 tons, the largest total for any other week in almost a year. Activity in zinc also increased. In both lead and zinc the improved tone followed closely on reports to the effect that production is to be restricted. Tin was quiet and barely steady. Platinum was advanced sharply by the leading seller to $40 per oz. This was interpreted as pointing to a better understanding among producers in marketing the precious metal. Silver showed little change. Quicksilver was lowered to $90 per flask on increased competition with foreign material.

Copper Unsettled

Early in the fortnight the market for copper showed some improvement, both as to volume of business and prices. But publication of the May statistics on June 12 proved somewhat unsettling, for business again turned quiet and the price fell back to 8c., delivered Connecticut, after holding at 8¼c. for almost a week.

Foreign and domestic shipments for May declined to a new low for the movement, the combined total being 71,949 tons. This compares with the previous low of 79,213 tons in April, 1930.

The May statistics placed United States mine output at 45,671 tons, or a daily rate of 1,473 tons, the lowest for any month since the beginning of the business depression. Production of refined copper for North and South American showed little change.

Copper Exporters, Inc., reduced the export quotation 25 points on June 4, establishing the foreign price at 8.525c. Another 25-point reduction was announced today (June 18), bringing the price down to 8.275c., equal to 8c. on domestic business. Foreign sales for the month to date amounted to about 28,000 tons.

Lead Active

An excellent business was done in lead in the week ended yesterday. All the major buying interests were represented in the market, and miscellaneous buyers also acquired a fair tonnage. As was expected, figures for May, issued by the American Bureau of Metal Statistics, showed an increase in production from domestic ores and in refined metal stocks. Any unsettling influence that these figures might have had was apparently offset by reports of reductions in ore shipments and by increased sales tonnage on producers' books, which for June shipment already exceeds 30,000 tons. As noted elsewhere in this issue, the A. S. & R. announced a suspension of operations for the summer period at the company's smelters at Helena and Murray. These plants, however, will be open during this time for ore purchases.

Zinc Demand Subsides

Demand for zinc was fairly active early in the period, and the price firmed up in all quarters, advancing to 3.40c. per pound, St. Louis basis. Most of the buying was in forward material, with sheet mills apparently anxious for zinc for third- and fourth-quarter delivery. Most sellers were reluctant to quote on futures. The demand dried up pretty well in the last two or three days, and prices eased off, especially on prompt shipment material, for which there was virtually no inquiry.

Tin Quiet

Domestic consumers bought tin sparingly, and with little change in the general business situation prices held close to the 23c. level during the last two weeks. The International Tin Committee is considering the formation of a pool to absorb about 25,000 tons of tin to help stabilize the market.

Silver Quiet

Except for some purchases for China account, the market for silver was quiet and prices moved within narrow limits.

Other Metals

Quotations cover wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., delivered, Alcoa commercial and mill ingot, 99 and 98 per cent, 23.30c.; Alcoa No. 12 alloy, 22c.; metallurgical ingot, 94 per cent plus, 23.30c.; 98@99 per cent, 22.90c. London, £85, less 2 per cent, per long ton, for 98 per cent ingots and bars.

ANTIMONY—Per lb., duty paid, Chinese, spot, 6.05c.; futures, 6c. Cookson's "C" grade, spot, 12c. "CMC." grade, 99.9 per cent, spot, 11c.

BISMUTH—Per lb., in ton lots, $1.50. London, 5s. 6d.

CADMIUM—Per lb., 55c. London, 1s. 9½d.@1s. 10½d.

CHROMIUM—Per lb., 97@98 per cent grade, 85@90c. per lb. contained chromium, maximum 1 or 2 per cent iron.

COBALT—Per lb., delivered: Metal imported from Belgium in the form of rondelles, 97@99 per cent, spot, $2.50. Discounts on contracts. London, spot, 10s., subject to usual discounts.

INDIUM—Per gram, minimum 99 per cent, $14@$15; 98½ per cent, $90@$100 per oz.

IRIDIUM—Per oz., $105 for 98@99 per cent sponge and powder.

MAGNESIUM—Per lb., ingots (4x16 in.), 99½ per cent, 48c., in 100-lb. lots or more; 2½- or 3-lb. sticks (1⅛x27 in.), 53c., 100-lb. lots or more. London, 2s. 9d.@3s. for 99 per cent ingots or sticks.

MANGANESE—Per lb., 95@97 per cent, 42c.

MOLYBDENUM—Per lb., in 10- to 50-lb. lots, C.P. powder, $9; 97 per cent, $4.50. (Usually sold as calcium molybdate or ferromolybdenum, which see.)

NICKEL—Per lb. electrolytic cathodes, 35c.; shot and ingot made from remelted electro, 36c. for single lots of spot metal. London, per long ton, £170 @£175, as to quantity.

OSMIUM—Per oz., $60@$65. Nominal. London, £13 to £14.

PALLADIUM—Per oz., $19@$21. London, £3 12s. 6d.@£4.

PLATINUM—Per oz. Official price of leading interest advanced from $27.50 to $40 on June 8. Cash transactions between dealers and refiners at several dollars less. London quotes £5 2s. 6d. to £5 7s. 6d. Average price of Colombian crude for May, basis 85 per cent platinum, was $17.25.

QUICKSILVER—Per 76-lb. flask, $90. The market is unsettled on freer offerings of both foreign and domestic material, and prices are wholly nominal. London quotes £16 15s.

RADIUM—Per mg. radium content, $50 in lots of 4 grams or more, to $65 for 1 gram; smaller quantities, $70.

RHODIUM—Per oz., $50@$55.

RUTHENIUM — Per oz., $40@$45.

SELENIUM—Per lb., $1.80@$2, depending on quantity, for black, powdered, 99.5 per cent pure. London, 7s. 8d.@7s. 9d.

SILICON—Per lb., minimum 97 per cent Si, maximum 1 per cent Fe, 15@17c.

TANTALUM—Per kilo, $91 for C.P. bar or sheet.

TELLURIUM—Per lb., $2. London, 9s. 6d.

THALLIUM—Per lb., $12.50@$15.

TITANIUM—Per lb. in 50- to 100-lb. lots, 75 per cent, $5.

TUNGSTEN—Per lb. contained tungsten, 98 per cent, powdered, $1.45.

Metallic Ores

Prices in tons of 2,000 lb., or in "units" of 20 lb., unless otherwise stated.

ANTIMONY ORE—No sales reported. London, per long ton unit, 2s. 6d.@3s. for 60 per cent sulphide ore.

Daily Prices of Metals

June	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
4	7.975	22.40	3.75	3.60	3.20
5	8.025	22.50	3.75	3.60	3.25
6	8.025	22.40	3.75	3.60	3.25
8	8.025	22.30	3.75	3.60	3.25
9	8.025	22.50	3.75	3.60	3.25
10	8.025	23.10	3.75	3.60	3.30
Av'ge	8.017	22.533	3.750	3.600	3.250
11	8.025	23.40	3.75	3.60	3.35@3.40
12	7.775	23.20	3.75	3.60	3.40
13	7.775	23.25	3.75	3.60	3.40
15	7.825	22.75	3.75	3.60	3.40
16	7.775	22.875	3.75	3.60	3.35
17	7.775	22.70	3.75	3.60	3.30@3.35
Av'ge	7.825	23.029	3.750	3.600	3.375

Average prices for calendar week ended June 6, 1931, are: Copper, 7.967c.; Straits tin 22.417c.; New York lead, 3.750c.; St. Louis lead, 3.600c.; Zinc, 3.238c.; Silver, 26.417c.

Average prices for calendar week ended June 13, 1931, are: Copper, 7.942.; Straits tin, 22.958c.; New York lead, 3.750c.; St. Louis lead, 3.600c.; Zinc, 3.329c.; Silver, 26.458c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices of refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary forms of wirebars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight differential. The contract price for High-Grade zinc delivered in the East and Middle West is 1c. above the St. Louis price for Prime Western.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

Silver, Gold, and Sterling Exchange

June	Sterling Exchange "Checks"	Silver		Gold, London	May June	Sterling Exchange "Checks"	Silver		Gold, London
		New York	London				New York	London	
4	4.86⅜	26⅜	12 5/16	84s11⅜d.	11	4.86 3/16	26⅜	12¼	84s11½d
5	4.86⅜	26⅜	12¼	84s11⅜d	12	4.86 1/16	26½	12 5/16	84s11½d
6	4.86 5/16	26½	12 5/16	.....	13	4.86½	26½	12⅜	.....
8	4.86¼	26⅝	12⅜	84s11⅜d	15	4.86¼	26½	12 5/16	84s11½d
9	4.86¼	26½	12 5/16	84s11¼d	16	4.86¼	26⅝	12⅜	85s00½d
10	4.86¼	26¼	12 3/16	84s11½d	17	4.86⅛	26⅛	12⅜	84s10½d

Average for week ended June 10: Silver, 26.438c.; Sterling Exchange, $4.86302.

Average for week ended June 17: Silver, 26.521c.; Sterling Exchange, $4.86167.

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis of 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-sixteenths of a cent premium.

London

June	Copper Standard		Electrolytic (Bid)	Tin		Lead		Zinc	
	Spot	3 M		Spot	3 M	Spot	3M	Spot	3 M
4	34	34⅝	38	100¼	102	10⅜	10¾	9 11/16	10 5/16
5	35⅜	36	38	100½	102⅛	10 15/16	11 3/16	9 15/16	10½
8	34½	35¼	38	100⅝	102⅛	10⅝	11	10	10 9/16
9	35 3/16	35 15/16	38	100¾	102⅜	10⅞	11 5/16	10¼	10 13/16
10	35 3/16	35⅞	38	103⅛	104⅜	11 5/16	11 11/16	10⅞	11 7/16
11	36 1/16	36⅞	39	105⅜	106⅛	11½	12	11 5/16	11⅞
12	35 3/16	35⅞	38½	104½	106	11 1/16	11½	10¾	11¼
15	34½	35¼	38	102⅜	104	11 1/16	11½	10⅞	11⅜
16	34⅜	35	38	101¾	103⅜	11¼	11 11/16	11	11½
17	34 5/16	35	37½	101⅛	102⅞	11 5/16	11 11/16	11⅛	11 11/16

Prices for lead and zinc are the official price for the morning session of the London Metal Exchange; prices for copper and tin are the official closing buyers' prices. All are in pounds sterling per long ton (2,240 lb.).

BERYLLIUM ORE—Per unit of BeO, minimum 11 per cent BeO, $4@$5, f.o.b. mines. Per lb. BeO contained, 30c., c.i.f. European ports. Nominal.

CHROME ORE—Per long ton, c.i.f. Atlantic ports, Indian ores, $19 for 46@48 per cent Cr_2O_3 ore, and $23.50@$24 for 50@51 per cent ore. London, 75s. for 48 per cent Rhodesian, and 77s. 6d.@88s. for Indian and New Caledonian, according to quality.

IRON ORE—Per long ton, Lower Lake ports. Lake Superior ores.

Mesabi, non-bessemer, 51½ per cent iron, $4.50. Old Range, non-bessemer, $4.65.

Mesabi, bessemer, 51½ per cent iron, $4.65. Old Range, bessemer, 51½ per cent, $4.80.

Eastern ores, cents per long ton unit, delivered at furnaces: Foundry and basic, 56 to 63 per cent, 10c.

Foreign ores, alongside docks Atlantic ports, cargo lots, cents per long ton unit:

North African and Swedish, low-phosphorus, 9@9½c.

Spanish and North African basic, 50@60 per cent, 9c.

Swedish foundry or basic, 65@68 per cent, 9@9½c.

Newfoundland foundry, 55 per cent iron, 9c. Nominal.

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, cargo lots, exclusive of duty: Brazilian, 46@48 per cent Mn, 23c.; Chilean, 47 per cent minimum, 29c.; Indian, 48@50 per cent, 25@26c.; Caucasian, 52@55 per cent, 26@27c.; South African, 52@54 per cent, 25@26c.; 50 to 52 per cent, 24@25c; 44 to 46 per cent, 23½c.

Per ton in carload lots:

Chemical grades, powdered, coarse or fine, minimum 80 per cent MnO_2, Brazilian or Cuban, $60. Javan or Caucasian, 85 per cent minimum, $60. Domestic, 70 to 72 per cent, $60, f.o.b. mines.

MOLYBDENUM ORE—Per lb. of contained MoS_2, nominally 45c., delivered Pittsburgh. London, per long ton unit, nominal at 28s.@30s. for 80@85 per cent concentrate.

TANTALUM ORE—Per lb. Ta_2O_5, 70c. for 60 per cent ore. Market nominal.

TIN ORE — No market in United States. London, returning charge on 60 per cent Bolivian, £8 15s.@£9 per long ton; on 70 per cent Nigerian, £6 17s. 6d., basis £200.

TITANIUM ORE — Per gross ton. ilmenite, 45@52 per cent TiO_2, f.o.b. Atlantic seaboard, $10@$12, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7 @$8. Rutile, per lb., guaranteed minimum 94 per cent concentrate, 10c.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Chinese wolframite, $11.25, duty paid. Bolivian scheelite, $11.50.

Domestic, $12. Shipments of odd carlots do not command full prices.

VANADIUM ORE—Per lb. V_2O_5 contained, 27c., f.o.b. shipping point. London, 16 to 18 per cent V_2O_5, nominal at 45s.@47s. 6d. per long ton unit, c.i.f., on contract.

ZIRCON ORE — Per ton, 55 per cent ZrO_2, f.o.b. Atlantic seaboard, $40@$45 in 30-ton lots. Crude granular zircon, $70, f.o.b. Suspension Bridge, N. Y.; milled, $90.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.
Tons of 2,000 lb., unless otherwise noted.

AMBLYGONITE — Per ton, f.o.b. mines, 8@9 per cent Li_2O, $50@$60.

ASBESTOS — Per ton, f.o.b. Quebec mines, tax and bags included: Crude No. 1, $250@$350; crude No. 2, $200@$250; spinning fibers, $90@$175; magnesia and compressed sheet fibers, $100@$125; various grades shingle stock, $45@$65; various grades paper stock, $27.50@$35; cement stock, $15@$20; floats, $10@$12.

Per ton c.i.f. New York: Rhodesian crude No. 1, $300; No. 2, $200. Nominal.

Per ton, c.i.f. New York: Russian crude No. 1, $220@$250; No. 2, $175@$200; No. 3, $125@$150. Nominal.

Per ton, f.o.b. mines, Vermont: Shingle stock, $55; paper stock, $35; cement stock, $20.

BARIUM CARBONATE (Witherite) — Per ton, 90 per cent, 200 mesh, $47; 100 mesh, $44.

BARYTES—F.o.b. mines, bags extra:

Georgia: Barytes ore, crude, $6@$6.50 per long ton.

Missouri: Per ton, water ground and floated, bleached, $23, car lots, f.o.b. works. Crude ore, minimum 95 per cent $BaSO_4$, less than 1 per cent iron, $6.50; 1 per cent iron and 93 per cent $BaSO_4$, $6, f.o.b. mines.

BAUXITE—Per long ton: Domestic ore, chemical, crushed and dried, 55 to 58 per cent Al_2O_3, 1.5 to 2.5 per cent Fe_2O_3, $6.50@$8, f.o.b. *Alabama* and *Arkansas* mines. Other grades, 56 to 59 per cent Al_2O_3, 5 to 8 per cent SiO_2, $6@$7.50, f.o.b. *Arkansas* mines. Pulverized and dried, 56 to 59 per cent Al_2O_3, 8 to 12 per cent SiO_2, $10@$12.25, f.o.b. *Arkansas* mines; abrasive grade, crushed and calcined, 78 to 84 per cent Al_2O_3, $14@$16, f.o.b. *Arkansas* mines.

Per metric ton, foreign, c.i.f. Atlantic ports: Dalmatian, 50 to 55 per cent Al_2O_3, 1 to 3 per cent SiO_2, $4.50@$6.50. Istrian, 54 to 57 per cent Al_2O_3, 3 to 5 per cent SiO_2, $5.50@$7; French, 56 to 59 per cent Al_2O_3, 2 to 4 per cent SiO_2, $6@$8.

BENTONITE—Per ton, carload lots, f.o.b. Wyoming mines, dried and crushed, in bulk, $8; in bags, $10. F.o.b. Chicago, selected air-floated, $25.

BORAX — Per ton, carload lots, in bags, crystals, $56; granulated, $50; powdered, $57.50; f.o.b. shipping point.

[1]CELESTITE—Per ton in carload lots, 90 per cent $SrSO_4$, finely powdered, $27.

CHINA CLAY (KAOLIN)—Per ton, f.o.b. *South Carolina* mines, crude lump, No. 1, $5; crushed air-floated, $7; pulverized, $9@$10.

Florida, washed and crushed, No. 1, $12.50; No. 2, $12.

Delaware, No. 1, $14.50.

Imported English, f.o.b. American ports: lump, $17@$21 in bulk.

EMERY—Per ton, f.o.b. *New York,* domestic crude ore, first grade, $10. Other American ore, delivered to grinders, per gross ton, $15; Turkish and Naxos ore, $30@$35. F.o.b. *Pennsylvania,* in 350-lb. kegs, Turkish, Khasia, and Naxos grain emery, 6½c. per lb.; American, 3½c.

FELDSPAR — Per ton, f.o.b. *North Carolina,* potash feldspar, 200 mesh, white, $15, in bulk; soda feldspar, $18. F.o.b. *Maine,* potash feldspar, white, 200 mesh, $19, in bulk. Granular glasspar, f.o.b. *North Carolina,* $10.50 in bulk.

Virginia, No. 1, 325 mesh, $17; 200 mesh, $15@$15.50; 160 mesh, $14; No. 1 glassmakers', $11; enamelers', $12.50.

New Mexico: Crude clean No. 1 potash spar, $4.75; ground, $9.50.

FLUORSPAR — Per ton, f.o.b. *Kentucky* and *Illinois* mines:

Gravel, not less than 85 per cent CaF_2, and not over 5 per cent SiO_2, $13@$15. Foundry lump, 85-5, $17. Ground, 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50 in bulk; $36.50 in bags or barrels. *Colorado* mines, 82-5, $12.75.

Foreign fluorspar, gravel, 85-5, $18.50 per gross ton, duty paid.

FULLER'S EARTH — Per ton, f.o.b. *Colorado,* $18, various finenesses to minus 90 mesh.

F.o.b. *Georgia* or *Florida.* 30 to 60 mesh, $17; 15 to 30, $16; 200 up, $10; 100 up, $7.

GARNET—Per ton, f.o.b. *New Hampshire* mines: concentrate, $40; washed grades, $125.

New York: Adirondack garnet concentrates, $85.

Spanish grades, $60, c.i.f. port of entry.

GILSONITE — Per ton, carload lots, f.o.b. *Colorado:*

Brilliant black, $31.65; seconds (mine run), $25.50.

Selects, $30.50, f.o.b. Utah. Nominal.

GRAPHITE—Per lb., f.o.b. *New York:* Ceylon lump, 6½@7½c.; carbon, lump, 3@6c.; chip, 5@6c.; dust, 2½@4c.; Madagascar flake, 4@6c.

No. 1 flake, 8@16c.; No. 2, 6c. upward; fine ground, 3c. upward; amorphous, 3c. upward.

Crude amorphous graphite, $15@$35 per ton, according to grade.

GREENSAND — Per ton, f.o.b. cars, *New Jersey:* Screened and bagged, best grade, in carload lots, $20.

GYPSUM—Per ton, f.o.b. mill, crushed rock, *Iowa,* $2.50; *Ohio* and *New York,* $3. Ground, *Ohio,* $4; *Iowa,* $6. Agricultural, $6@$7. Calcined, $6@$9.

IRON OXIDE (See Ocher)—Per lb.: Standard Spanish red, 3@4½c.; domestic earth, 2@4½c.

KAOLIN—See China Clay.

LEPIDOLITE—Per ton, $50@$60 for ordinary grades. Nominal.

LIMESTONE—Per ton, f.o.b. shipping points, depending on location, either lump or crushed, 25c.@$1.75.

Agricultural, $1 up to $6 per ton, as to grade and point of shipment.

MAGNESITE—Per ton, f.o.b. *California,* dead-burned, $28. Kiln run, 93 per cent MgO (artificial periclase), $70; 88 per cent MgO, $38. Caustic, 95 per cent MgO, $48; 90 per cent, $40. *Washington:* Dead-burned grain magnesite, $22.

MICA—Per ton, f.o.b. *New Mexico,* scrap, white, $21; off color, $18. Punch, white, for disks, per lb., 10c.; for washers, 8c.

Per ton, f.o.b. *New Hampshire,* roofing mica, $23; snow, $34; 40 mesh white, $40; 60 mesh, $48; 100 mesh, $60; 200 mesh, $75. Clean dry mixed bench and mine scrap, $13.

Per lb., f.o.b. *North Carolina*: Punch, 4@5c.; 1½x2 in., 25@35c.; 2x2, 45@60c.; 2x3, 85c.@$1; 3x3, $1.40@$1.60; 3x4, $1.80@$2; 3x5, $2@$2.25; 4x6, $2.75@$3; 6x8, $3.50@$3.75; 8x10, $5@$7.50. These prices apply both to No. 1 and No. 2 mica. Black-stained mica takes a discount of 10 to 25 per cent from this schedule. White North Carolina mica, 70 mesh, $60 to $80. Biotite, or black mica, $15 a ton, unground.

MINERAL BLACK—(Graphitic shale) —Per ton, 325 mesh, 75 per cent carbon. $22.50, f.o.b. *Virginia.*

MONAZITE—Per ton, minimum 6 per cent ThO_2, $60.

OCHER — Per ton, f.o.b. *Georgia* mines, $17.50 in sacks; $20 in barrels; second grade, $10. Buff clay, 98 per cent through 325 mesh, $18.

F.o.b. *Virginia,* dark yellow, 300 mesh, 60 per cent ferric oxide, in jute bags, $19.50.

PHOSPHATE—Per long ton, f.a.s. or f.o.b. mines:

Florida, pebble, f.a.s., for export: 76@77 per cent, $7.15; 75 per cent, $6.40; 74@75 per cent, $6.15; 70 per cent, $4.65; 68 per cent, $4.10.

Florida, pebble, domestic: 76@77 per cent, $6.50; 74@75 per cent, $5.50; 72 per cent, $4.50; 70 per cent, $4.

Tennessee, ground lime phosphate, 80 per cent through 300 mesh, 33 per cent P_2O_5, $12.80 per net ton, bags extra.

PUMICE STONE—Per lb., in barrels, powdered, 2½@4c.; selected lump, 5@7c.

PYRITES—Per long ton unit of sulphur, c.i.f. United States ports, guaranteed 48 per cent sulphur, Spanish, 13@13¼c.

POTASH—Per ton, contracts:

	Bags	Bulk
Muriate of potash, 80@85 per cent, basis 80 per cent	$37.15	$35.55
Sulphate of potash, 90@95 per cent, basis 90 per cent	48.25	46.65
Sulphate of potash-magnesia, 48@53 per cent, basis 48 per cent	27.80	26.20
Manure salt, 30 per cent	22.15	19.15
Manure salt, 20 per cent	15.65	12.65
Kainit, 14 per cent	12.70	9.70

Prices are delivered to Atlantic ports. Discounts up to 4 per cent for early shipment. Spot prices, $1.25@$1.50 per ton higher than on contract.

[1]QUARTZ ROCK CRYSTALS—For fusing, all sizes, $250 per ton. Prisms for piezo-electrical use, $3 per lb. in small lots. Optical grades command premium.

SILICA—Per ton, water ground and floated, in bags, f.o.b. *Illinois:* 325 mesh, $16@$40 for 92 to 99½ per cent grades. Dry ground, air-floated, 325 mesh, 92@99½ per cent silica, $14@$30. Market steady. Glass sand, f.o.b. producing plant, $1.25@$5 per ton; molding sand, 50c.@$3.50; blast sand, $1.75@$6.

[1]STRONTIANITE — Per ton, lump in carload lots, minimum 90@92 per cent $SrCO_3$, $100.

SULPHUR—Per long ton for domestic market, $18 f.o.b. Texas mines; $22 for export, Atlantic ports.

TALC — Per ton, carload lots, f.o.b. works, containers included unless otherwise specified:

New Jersey: Soapstone, ground, $10@$12.

New York: Double air-floated, short fiber, 200 mesh, $13.75; 325 mesh, $14.75.

Vermont: 99 per cent through 200 mesh, extra white, bulk basis, $8@$8.50; 97 to 98 per cent through 200 mesh, medium white, $7@$7.50. Packing in paper bags, $1 per ton extra.

Virginia: 200 mesh, $6@$7.75; 325 mesh, $8.75@$10.50.

TRIPOLI — Per ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh, rose and cream colored, $15. Double ground through 110 mesh, rose and cream, $17. Air-floated through 200 mesh, rose and cream, $22.50.

Metallic Compounds

ARSENIOUS OXIDE (White arsenic)—Per lb., 4c., delivered, all positions. London, per long ton, £19½ for Cornish white. Mexican, high grade, £17 10s.

CALCIUM MOLYBDATE OR MOLYTE—Per lb. of contained Mo, 85c.

COBALT OXIDE—Per lb., black, 70@71 per cent contained Co, $1.35@$1.45. London 5s. for black; 6s. 3d.@6s. 6d. for gray.

COPPER SULPHATE (Blue Vitriol)—Per lb., in car lots, 3.90c. for either large or small crystals.

GERMANIUM DIOXIDE—Per gram, in 200- to 300-gram lots, $3.50.

SODIUM NITRATE—Per 100 lb., crude natural, in bags ex vessel, Atlantic ports, $2.05.

SODIUM SULPHATE (Salt Cake)—Per ton, bulk, f.o.b. works, $15@$18.

ZINC OXIDE—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6¼c.; French red seal, in bags, 9⅜c.

ZIRCONIUM DIOXIDE—Per lb. in 100- to 500-lb. lots, 87 per cent ZrO_2, commercial, 50c.

Refractories

CHROME BRICK—Per ton, f.o.b. shipping point, $45. Grecian refractory ore, 37@42 per cent, 40c. per unit.

FIRECLAY BRICK — Per M., first quality, $40, *Ohio, Kentucky, Central Pennsylvania;* second quality, $35.

MAGNESITE — Brick, per ton, f.o.b. works, 9-in. straights, $65. Dead-burned grain, $40, f.o.b. Chester, Pa., or Baltimore.

SILICA BRICK—Per M., *Pennsylvania,* $40; *Alabama,* $50@$51; *Illinois* and *Indiana,* $49.

ZIRKITE—Per lb., powdered, 65@70 per cent ZrO_2, 3½c. Brick, straights. 80c.@$1 each.

Alloys

FERROCHROME — Per lb. of contained chromium, 4 to 6 per cent carbon, 65 to 70 per cent chromium, 11c., delivered, on contracts; spot, 11½c. Containing 2 per cent carbon, 67 to 72 per cent chromium, spot, 17½c.; maximum 0.10 per cent carbon, 26c., spot; 24½c. contracts.

FERROMANGANESE — Per gross ton furnace: domestic and foreign, 78@82 per cent, $80@$85, contracts, depending on quantity. Spiegeleisen, 19@21 per cent, $30 for spot carloads.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.

FERROPHOSPHORUS—Per gross ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50, f.o.b. *Alabama* and *Tennessee.*

FERROSILICON — Per gross ton, delivered, 50 per cent, $83.50; 75 per cent, $130; 14@16 per cent, $31, f.o.b. Niagara Falls, N. Y. Spot shipments $5@$10 per ton higher on 50 and 75 per cent grades.

FERROCARBONTITANIUM — Per ton, $150, f.o.b. producer's plant, carlots.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1@$1.10, f.o.b. works.

FERROVANADIUM—Per lb. of V contained, delivered, $3.15@$3.50.

SILICOMANGANESE — Per long ton, carload contracts, delivered, $105 for maximum 2½ per cent carbon; $115 for maximum 1 per cent carbon.

SILICON ZIRCONIUM—Per lb., 47@52 per cent Si, 35@40 per cent Zr, 18@21c.

ZIRCONIUM FERROSILICON—Per gross ton, 12@15 per cent Zr, 39@43 per cent Si, $103.50@$108.50.

Rolled Metals

COPPER — Per lb., sheets, hot-rolled, 18⅛c.; wire, f.o.b. mill, 9¾c.

LEAD SHEETS — Per lb., full rolled, 7c.; clipped, 7¼c.

MONEL METAL—Per lb., sheets, full finished, 42c.; rods, hot-rolled, 35c.

MUNTZ METAL—Per lb., rods, 14¾c.; plates, 17⅝c.

NICKEL—Per lb., sheets, full finished, 52c.; rods, hot-rolled, 45c.

NICKEL SILVER — Per lb., sheets, 10 per cent, 23@23⅜c.; 18 per cent, 26½@26⅞c. Wire and rods, 10 per cent, 26½c.; 15 per cent, 30½c.; 18 per cent, 34c.

PHOSPHOR BRONZE—Per lb., sheets and rods, 5 per cent tin, 29⅜c. wire, 5 per cent, 29⅞c.; 10 per cent, 35⅜c.

ZINC SHEETS — Per lb., 8¼c., f.o.b. works; ribbon 8¼c.; 7 per cent discount on orders for 18 tons or more.

Iron, Steel, and Coke

IRON—Per gross ton, Valley furnaces: Bessemer, $17; basic, $15.50; and No. 2 foundry, $16.

STEEL—Per gross ton, base prices, Pittsburgh, billets and slabs, $29@$30; bars, plates, and structural shapes, per 100 lb., $1.65.

COKE—Per ton, Connellsville furnace, $2.40@$2.50. Connellsville foundry, 3.50@$4.25. Byproduct coke, Ohio and Kentucky (Connellsville basis), $5.50; Buffalo and Detroit, $8@$8.50; Birmingham, foundry, $5; furnace, $3.50@$4.50.

[1]Price furnished by Foote Mineral Company, Philadelphia.

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A PLATFORM FOR AMERICAN BUSINESS

A Statement of Underlying Principles with some Practical Suggestions to Guide in Planning Future Progress

PRESENTED BY McGRAW-HILL PUBLISHING COMPANY, INC.

THE BUSINESS DEPRESSION of 1930 was no mere passing episode. The appalling loss and suffering entailed have struck home the more forcibly because they followed a period of unparalleled prosperity in a country that still possesses vast wealth and abundant resources. As a result of its duration and severity, the depression has shocked business, governmental and social agencies into commendable activity for the relief of human suffering and distress.

But, what is more significant for the future, it has also aroused an insistent demand for a searching analysis of the weak spots of the business and economic systems under which such a calamity was possible. It is an encouraging sign that men are beginning to question whether these recurring periods of boom and depression are not preventable; whether it is possible under better management to insure greater security to all classes of people who are willing to work; whether their faith in American achievement and standards of living can be preserved.

Evidence is multiplying that these questions can be answered in the affirmative; that this challenge to the American business and economic systems can be met in such a manner as to justify our confidence in them. Instead of regarding business depression as a storm to be weathered or a condition that must be endured and allowed to "work itself out," thinking men are beginning to look upon it as an economic plague that can be averted and wiped out by preventive measures. Sentiment is stirring in favor of doing something about it, heeding the warning of our latest experience and preparing actively to meet the issue it raises.

It is the responsibility of the business press to crystallize constructive policies and to encourage progressive leadership. Therefore, the McGraw-Hill Publishing Company desires to do its part in helping to clarify the situation and to stimulate thought and action. It believes in the philosophy of individual enterprise and cooperative effort on which American achievement has been based. And it has confidence in the ability of American management to recognize and adopt sound economic principles as a basis for constructive business policies. But it is equally certain that only by conscientious effort on the part of each business unit, large or small, can American business as a whole return to normal and pursue a steady course.

PLANNING IS ESSENTIAL for uninterrupted progress. To assist in such a program the McGraw-Hill Publishing Company offers through its publications the following principles and practical suggestions as a guide in formulating individual plans. They are not presented as a ready-made formula for success, but as a foundation on which business can be built with some protection from the shocks and dislocations that have plagued it.

quota. Where the volume of business does not warrant this increase in the form of operating expenses, the money may be placed in capital expenditures—modernization, research for development, new patents, etc.

B. Each business enterprise has a responsibility to aid in the development of regional and national resources.

Development of National Resources

(1) Encourage and cooperate in the coordination and promotion of the economic area in which you are located through constructive programs for the improvement of agricultural, commercial, industrial and community development. (*Example*—New England Council.)

(2) Assist in the work of national associations devoted to the improvement of business ethics, the promotion of higher standards in the commercial, industrial, financial and political administration of the country, and the simplification of the laws governing business. (*Example*—Chamber of Commerce of the United States.)

IV—Maintenance of World Business

Probably the greatest potential market for present and future American products lies in that foreign field represented by the present difference between the living standards of the American public and those of a billion and a half people in many other countries. Any slight increase in the living standards of these vast populations will bring immediate benefits to American manufacturers, as the largest producers of those commodities contributing to labor saving and luxury.

A. Support cooperative studies and formulation of world policies among business interests through international business organizations on such subjects as —

International Business Cooperation

(1) World tariffs.
(2) Trade discriminations.
(3) International movement of capital.
(4) War debts and reparations.

B. Promote uniformity in foreign trade practice by encouraging coordination among organized industries.

C. Carry this long term planning into sales control, involving distribution methods, sales forecasting and pricing.

Sales Control

(1) Revise present methods of distribution and service to conform to the best interests of the customer. (*Example*—establishment of retail stores by mail order houses.)

(2) Prepare sales forecasts by products and by markets with regard to competition. (Leading institutions have found that modern sales forecasting can be correct within 2 to 3% for a year ahead and within 5 to 15% for three years ahead.)

(3) Know costs and stop selling at a loss. Maintain firm minimum prices based on production costs. (Business history shows a high degree of prosperity among those companies, large or small, which have had the courage to stand on a minimum price that insured a profit.)

(4) Plan sales organization, sales program and advertising on at least a three-year basis.

D. Plan for uniform production as far ahead as possible on the basis of sales requirements already determined.

Production Modernization

(1) Modernize and replace every existing production facility, including plants, factory and office equipment and methods where it is possible to effect cost reduction and greater production flexibility. (Stores, banks, and offices have a production problem no less than factories.)

(2) Do not expand production facilities in the mere hope for lower costs through larger production, but only where the long term forecast shows the necessity for additional facilities.

(3) Base purchase of materials, supplies and equipment upon the marketing and production program for the three-year period and make purchases as far ahead as practicable.

E. Stabilize financing. Working capital requirements for labor and material, and business capital requirements for development and expansion, can be determined with reasonable accuracy for a period ahead by long term planning.

Financial Policies

(1) Do not depend permanently upon bank credit for purposes other than short-term loans for current working capital. (In the interim partial payment financing of equipment, etc., is widely accepted as sound business practice.)

(2) Raise needed fixed capital requirements by bond or stock issues whenever reasonably advantageous.

(3) Invest surplus in short-term commercial paper or good bonds rather than employing it in call money or for purely speculative purposes.

Many of America's soundest corporations have adopted these financial policies.

GENERAL OBJECTIVES

The following general objectives are fundamental in planning sound business developments:

1. Maintenance of Established Standards of Living

The belief that there is danger of a general overproduction of wealth, that technical development necessarily involves unemployment, or that standards of living cannot be indefinitely increased is an economic fallacy. American business should not yield to it in any of the policies it pursues. Rather it must protect and preserve our economic standards and social traditions by maintaining high purchasing power and regularity of employment and dividend disbursements, based on more stabilized methods of management and financing made possible by long-term planning.

RECOMMENDATION: Conserve and add to the gains achieved in the past ten years through technical advance, improved forms of industrial organization and methods of management, and new devices for financing industrial and market expansion. Increase efficiency in the economic production and distribution of goods and services so as to facilitate their widest possible consumption and thereby raise the standard of living of the American people.

2. Stabilization of Future Business Growth

So long as there are wide fluctuations in business and in price levels, the gains to some groups are cancelled by losses to others and there is no net gain to the country as a whole. The interests of the speculative and creditor groups should be subordinated to the interests of those concerned with the production and distribution of goods and services. The latter should have a larger measure of leadership in business policy to insure sound and lasting prosperity.

This leadership can be exercised only by a more deliberate process of long term planning and organization for the direction and development of business operations. Such effort involves market analysis, sales control, product development, modernization of factory and office methods, foresight in purchasing, long-term financing of fixed capital requirements and a stimulated program of capital investment in 1931 for the restoration of business volume. All this must be supported by broader policies of coordination within the industry or trade, cooperation with labor and participation in the organized development of regional and national resources.

RECOMMENDATION: Direct individual and organized effort to check excessive and unbalanced industrial and financial expansion, and prevent wide changes in price levels. This will remove the incentive to speculative gain, avoid conflict of creditor and debtor groups, and promote confidence in long-term investment and borrowing. It will also encourage productive and commercial enterprise, maintain a steady increase in consumer purchasing power and stabilize business progress.

3. Promotion of International Business Cooperation

The world is economically interdependent. Though the United States is the dominant factor in world prosperity, she cannot maintain or increase her own prosperity indefinitely without sharing it with the world, nor can her business system survive unless, by sharing its benefits, the other nations of the world can preserve their faith in it. This calls for a more active policy of international cooperation on the part of American business to assist in the gradual reduction or removal of unnecessary trade barriers that interfere with the natural exchange of goods and services between peoples, the development of a more stabilized international mechanism for the movement of capital and control of credit, and the revision of war debts and reparations.

RECOMMENDATION: Support individual or organized effort to promote cooperation among business and financial interests of the United States and other countries, in order to facilitate the normal international movement of goods, services and capital, and thereby enhance economic stability at home and elevate standards of living abroad.

4. Encouragement of Private Initiative and Responsibility vs. Extension of Governmental Activity

American business should encourage self-government. It has already shifted enough of its responsibility and thereby yielded enough of its initiative to government and must stand its ground against further extension of governmental action in matters in which it can assume responsibility itself.

The essential function of government is to keep clear the field of economic activity for private business initiative and to assure a basis of fair and equal competition in domestic and foreign trade. It should refrain from competing with any kind of business itself. It should facilitate and encourage the development of necessary controls upon business through organized self government. It should safeguard the economic stability of the country by maintaining stability in its own fiscal and international policies. It should reduce to the minimum the number of laws affecting business.

RECOMMENDATION: Oppose governmental regulation, control or expenditure which tends to limit or weaken private individual initiative or cooperative effort, or to diminish the responsibility of the individual business concern or organized industry, for the accomplishment of the objectives stated above.

RESPONSIBILITY FOR ACTION

This course of action for (1) the maintenance and elevation of American standards of living, (2) the stable development of American business, (3) the promotion of international cooperation and (4) the restriction of governmental encroachment upon private initiative and cooperative effort cannot be carried out without the earnest participation of individuals and organized groups representing all types of business and industrial activity.

Upon the following major groups the main burden of responsibility rests:

A. Industrial and Business Management: A few thousand business concerns in this country employ the bulk of the wage-earners, originate most of the consumer income, and produce the chief part of the goods and services that determine the standard of living. Upon the management of these concerns therefore rests the main responsibility for action that will:

(1) Formulate long-term plans for research, production, distribution, purchasing and financing.

(2) Support cooperative effort through industrial, trade and commercial organizations.

(3) Maintain wage scales that permit a high standard of living and purchasing power.

(4) Maintain and equalize employment by adjustment of working hours.

(5) Establish a reserve to protect the security of employment in times of reduced production.

(6) Establish and maintain stable prices.

(7) Maintain reasonable, stable dividends, conserving surplus accumulated in periods of prosperity for such use in slack times.

B. Industrial, Trade and Commercial Organizations: The power of business units is multiplied and their leadership is strengthened by vigorous, intelligent and far-sighted trade organizations. Through them it is possible to carry the foregoing principles into action on an industry-wide basis, which is necessary to their realization in each industry as a whole and to the even balance among all industries requisite to stable progress. They should cooperate in:

(1) Collection of data on costs, stocks, production, potential productive capacity and market conditions.

(2) Interchange of credit information.

(3) Development of codes of practice.

(4) Establishment of standards of employment salaries and wages within the industry.

(5) Development of opportunities for stabilizing business.

(6) Study of market development.

(7) Economic development and use of natural resources.

A CHECK SHEET of Practical Suggestions for Planning a Company Program

I—Long Term Planning of Business Operations

A. Definitely abandon the yearly period as the basis for business operations, except in accounting matters.

(1) Project business policies and planning, wherever possible, upon a three-year period or longer as a unit.

B. Initiate research from the customer's standpoint to determine:

Analyzing the Business

(1) To what extent established lines should be replaced, improved or simplified.

(2) What additional markets can profitably be penetrated with these lines.

(3) What new products can logically be added for present and new markets.

(a) Resist the temptation to pay out excessive sums in dividends in boom times. Rather place excess earnings in reserve and do not hesitate to use this reserve in slack times to maintain national purchasing power through dividend disbursements. (*Example*—U. S. Steel Corp. policy.)

II—Coordination with Industry or Trade

A. The success of long term planning for an individual business is multiplied and secured when similar policies are established throughout the industry.

(1) Aid in the establishment and share in the active development of an industry, trade or commercial organization—

(a) to collect data on costs, stocks, production, potential productive capacity and market conditions.

(b) to interchange credit information.

(c) to develop codes of practice.

(d) to take full advantage of legal trade cooperation.

(2) Cooperate to establish standards of employment, salaries and wages within your industry. (Labor is particularly susceptible to advantages offered by a business where long-term planning gives stable employment.)

III—Promotion of National Prosperity

A. The net profits of a modern business depend not only on its own activities but on sustained business stability throughout the country. There is a vital responsibility upon each business enterprise to do its share to provide national stability of purchasing power through —

Stabilization of National Purchasing Power

(1) A policy for employment.

(a) Establish a minimum payroll based on the planned program of production and sales and consider this minimum payroll as a fixed charge on the business. (*Example*—the Procter & Gamble plan.)

(b) Maintain a salary and wage scale that permits a high standard of living and thus of purchasing power.

(c) In slack periods, preserve the organization of trained personnel by reducing hours of work per man rather than reducing number of employees.

(d) Set up a reserve to protect the security of employment in times of reduced production.

(2) A policy for dividends.

(a) Resist the temptation to pay out excessive sums in dividends in boom times. Rather place excess earnings in reserve and do not hesitate to use this reserve in slack times to maintain national purchasing power through dividend disbursements. (*Example*—U. S. Steel Corp. policy.)

C. Banking and Financial Institutions: Next to the will and intelligence of individual and organized business, the most important factor in achieving the four objectives of this platform is the understanding and cooperation of the banking system in checking excessive inflation in times of prosperity and excessive deflation in times of depression. In the exercise of this function, business itself may well expect banking and financial institutions to:

(1) Require business management to think in terms of long-time planning where financial assistance is provided.
(2) Encourage corporations to accumulate substantial reserves in good times to be used in slack times for development and dividends.
(3) Discourage the extension of excessive credit in periods of unusual prosperity and in like measure facilitate legitimate credit in times of stringency.
(4) Assist in the promotion of mergers where real benefits can be obtained but oppose the merging of corporations for stock selling purposes.
(5) Lead in the development of international financial cooperation.

D. Labor: Stability of industrial and business operations requires a sympathy by American workers with the policies expressed in this platform, and a willingness to cooperate in making them effective. Responsibility rests upon labor as well as upon management if the worker is to enjoy the benefits of our business system. To this end labor should actively support these principles:

(1) That increased wages are dependent upon increased efficiencies in production and distribution.
(2) That business must be conducted profitably if labor is to enjoy higher standards of living.
(3) That employers operating on a program of long-time planning provide the maximum stability of employment.
(4) That labor should demand of their leaders an understanding of sound business principles.
(5) That the welfare of labor will best be served by recourse to arbitration and the avoidance of industrial strife.
(6) That the development of international trade is essential to domestic prosperity.
(7) That the extension of governmental activity hampers business in assuming its social responsibilities.

E. Government: The essential function of government is to keep clear the field of economic activity for private business initiative and to assure a basis of fair and equal competition. It can best promote sound economic development through these policies:

(1) Refrain from competing with any kind of business itself.
(2) Encourage the development of the necessary control of business through self-government rather than by legislation.
(3) Safeguard the economic stability of the country by maintaining stability in its own fiscal and international policies
(4) Exercise the greatest economy in public expenditures.
(5) Reduce to a minimum the number of laws affecting business.
(6) Cooperate with foreign nations for the fullest development of international trade.

AND IN CONCLUSION

THESE RECOMMENDATIONS can have value only as they are applied in the planning of individual company operations and in the programs of those industrial, commercial, financial and governmental agencies that are responsible for the conduct of our economic affairs. But taken broadly they constitute a platform of economic principles and business policies upon which far sighted management may well make a stand.

New conditions of our modern industrial civilization have laid new social responsibilities upon those men who guide the destinies of business enterprise. The protection of the welfare of workers and their security of employment and the assurance of permanent income to investors have become basic factors in the attitude of public opinion towards industry. And public opinion in the end has the power to preserve or to curtail that freedom of initiative around which the whole philosophy of American life has been organized.

Business management must meet the call of these responsibilities, therefore, if the people of the world are to be lifted out of the present depression and given assurance of greater stability of earning power in the future. Business leadership itself must strengthen and secure the success of this system of private initiative and cooperative effort upon which the prosperity of this country has been founded and of which it stands today as practically the sole exponent.

This proposed platform is being presented to American business through McGraw-Hill publications reaching into nearly every major industry in the country. It will be developed and interpreted editorially as a guide to the formulation of individual plans and business policies.

AS A FURTHER AID in that direction the reader will find within this supplement a check sheet of practical suggestions. Many of them are known to be practised by successful, well managed business concerns. It is believed that they will be of value and assistance to all American businessmen in planning for future progress and prosperity.

ROEBLING

NOT only in the transportation of men and materials—as in the case of Roebling Wire Rope—but in the transportation of electric current as well, are Roebling Products conspicuously serving mines everywhere. For example—Roebling Trolley Wire.

Trolley Wire, mining machine cable, mining locomotive cable, rubber covered wires and cables—these are merely a few of the Roebling Electrical Wires and Cables made for mine service. There is hardly an electric wire and cable need that cannot be satisfied by the complete and diversified Roebling Line.

May we send you further information regarding these Roebling Products? The nearest Roebling Office is at your service.

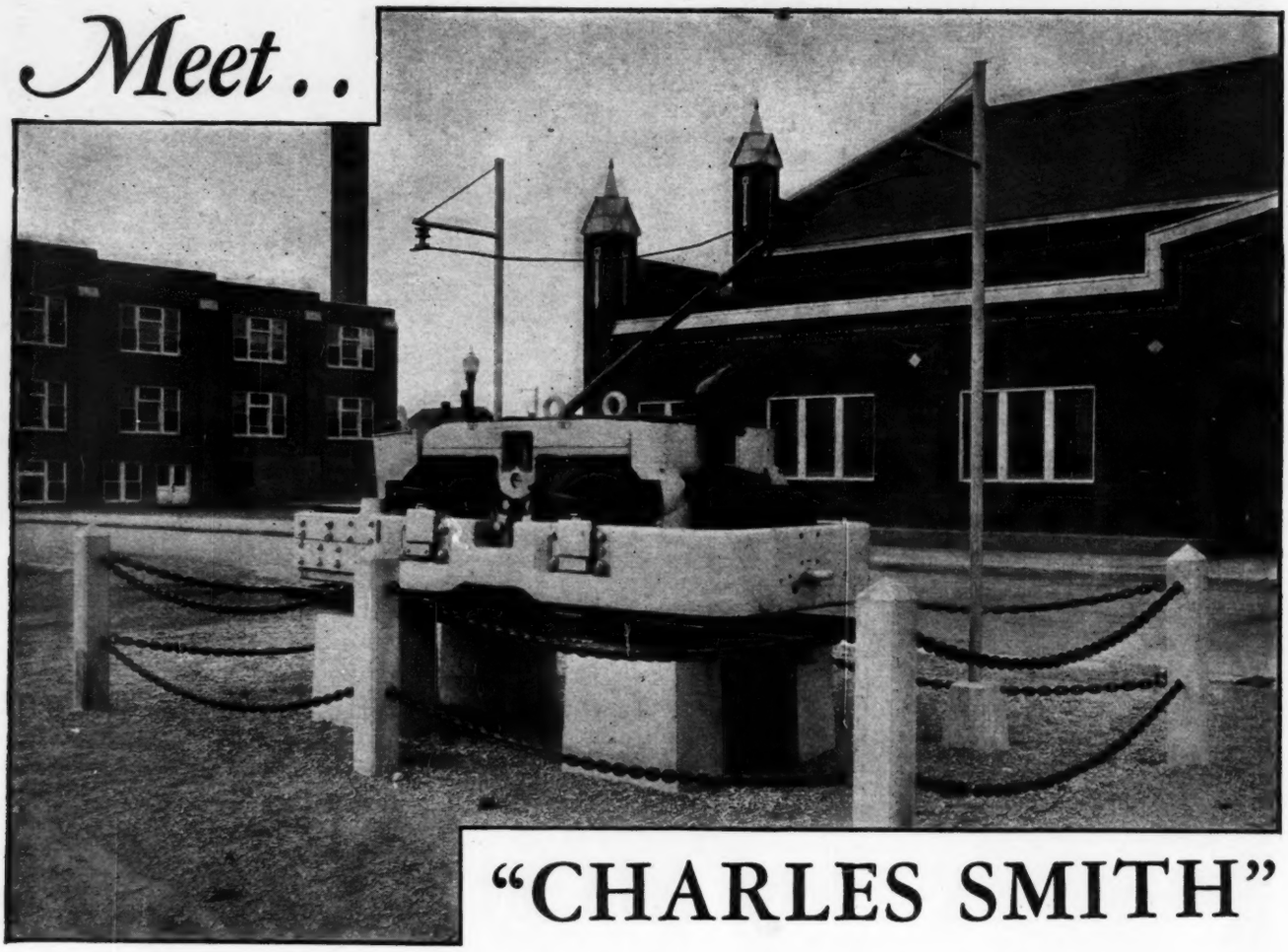
Mining Machine Cable » Mining Locomotive Cable » Rubber Covered Wires and Cables; braided and leaded » Trolley Wire » Armature and Field Coils » And a wide variety of other Wires and Cables.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N. J.

Atlanta Boston Chicago Cleveland Los Angeles New York
Philadelphia Portland, Ore. San Francisco Seattle Export Dept.—New York, N.Y.

ELECTRICAL WIRES AND CABLES

Meet . .



"CHARLES SMITH"

"CHARLES SMITH" is a General Electric mine locomotive believed to be the third electric locomotive used in this country. It was installed by the Union Pacific Coal Company, Rock Springs, Wyoming, on May 16th, 1892, and was named for the man who was its last regular operator.

"Charles" was born of good stock 'way back in the early "nineties," weighed nine tons, wore 30-inch-gauge shoes, and covered rails at a speed of eight miles per hour, thanks to one shunt-wound motor with a single field coil.

So hard did "Charles" work — he handled more than 7,000,000 ton-miles of coal; and at such low upkeep — he was the lightest eater of maintenance expense in the mine; that the officials were reluctant to retire him at the prime age of 34 years — yet he had earned it.

So they rewarded him by enrolling him in the Old Timers Association, exalted him on a pedestal, and placed a bronze tablet on his base to commemorate forever his pioneer distinction and remarkable service record.

To-day, as in the past, the G-E monogram on an electric mine locomotive is a mark of dependability — the initials of a friend.

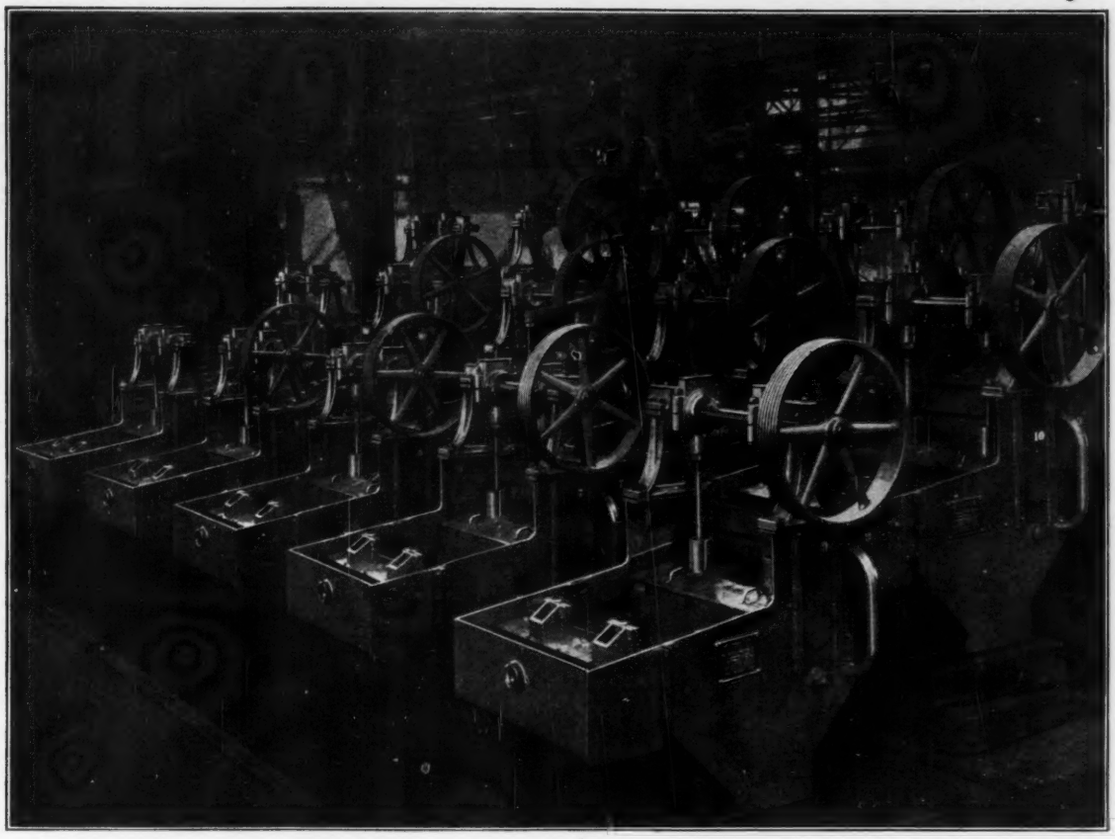
JOIN US IN THE GENERAL ELECTRIC PROGRAM, BROADCAST EVERY SATURDAY EVENING ON A NATION-WIDE N.B.C. NETWORK

360-66

GENERAL ELECTRIC

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

Five - 3 compartment Woodbury Jigs for Georgia Manganese and Iron Co. with individual motor and Texrope Drive.



Woodbury Jigs combine classifying and jigging operations and eliminate much preliminary separation

The economy of the Woodbury System of Concentration consists primarily in the simplification of the processes intervening between the crushing section of a mill and the smelter. Summarized, its advantages are as follows:

Capacity — Units of large capacity, thus retiring a large area of jig sieves.

Mixed Feeds — By uniting the classifying and jigging operations into one, fewer sizing screens and elevators are used, and hydraulic classifiers eliminated.

Slime Separation — A dense original slime, treated direct on tables, retires a large settling tank area.

Concentrates — Recoveries and grade of concentrates are increased.

Middlings — An improved middling classification, reducing quantity to be recrushed.

Tailings — Lower tailing losses obtained in all cases.

Water — Milling water less by one-half.

Power — Costs reduced materially.

Labor — Costs per ton of ore reduced.

Floor Area — Always less, and in some cases cut in two.

Construction — All iron and mechanically correct.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee

In Grinding Balls
Many Factors
go to make
PERFECTION
In the manufacture of Lorain Grinding Balls, from the selection of the best ore, up through all the steps in the production of special high-carbon steel, and then through forging, heat-treating, inspection and testing, every aid to perfection is employed without stint.
METALLURGICAL CONTROL
PRECISION OF ROLLING
SUPERIOR ORE
BETTER PIG IRON
SPECIAL REFINING
All sizes of balls common to cement and ore grinding stocked at Johnstown, Pa, for immediate shipment in carloads; and at Denver, Colo., for less carload shipments:-
¾", ⅞", 1", 1¼", 1½", 1¾", 2", 2½", 3", 3½", 4", 4½", 5"
LORAIN
FORGED, HEAT-TREATED GRINDING BALLS

THE LORAIN STEEL COMPANY

General Offices: 545 Central Avenue, Johnstown, Pa.

Subsidiary of United States Steel Corporation

Sales Offices: ATLANTA CHICAGO CLEVELAND DALLAS NEW YORK PHILADELPHIA PITTSBURGH

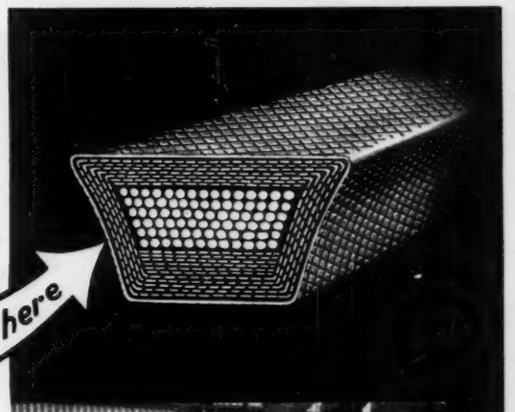
Pacific Coast Distributors: Columbia Steel Company, Russ Building, San Francisco, Calif.

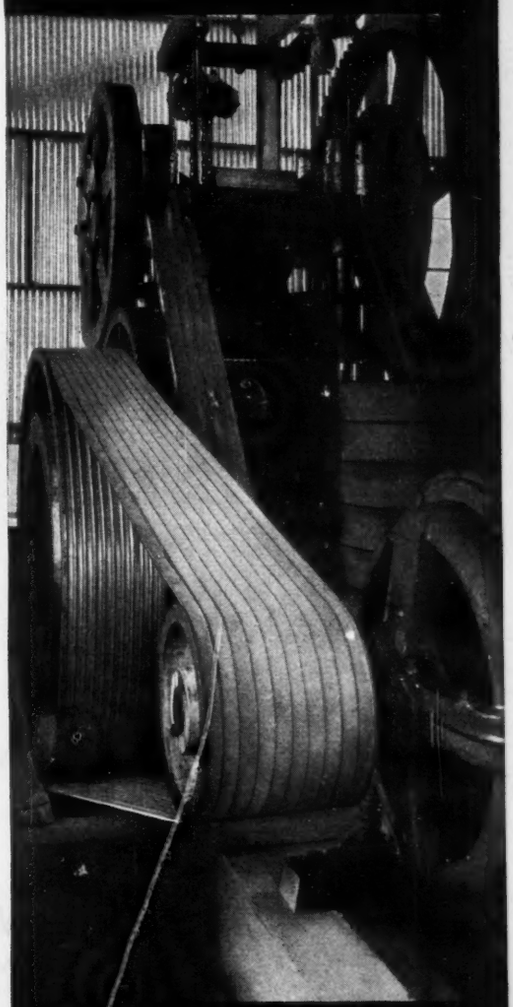
Export Distributors: United States Steel Products Company, 30 Church St., New York City, N. Y.

There's What Saves Transmission Dollars.... *that*

Concave Side

Right There





Watch ANY V-Belt in action and here is what you will see—

The top of the belt, as it bends around the pulley, is under tension and grows NARROWER. The bottom is under compression and grows WIDER, the sides of the belt BULGE OUT.

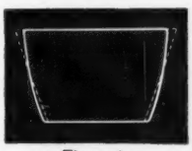


Figure 1.

A straight-sided V-Belt is therefore forced to assume, in the sheave groove, the shape shown by dotted lines in figure 1. TWO losses result:

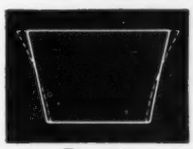


Figure 2.

(1) The bulging causes UNEVEN wear on the sides of the belt--SHORTER LIFE! (2) The full side of the belt does not uniformly grip the pulley—lower transmission efficiency.

Contrast with this the belt built with the CONCAVE side (U. S. Patent 1,400,539)—the Gates Vulco Rope.

As this belt bends, the concave side becomes straight (Fig. 2). It EXACTLY FITS the sheave groove. Two distinct SAVINGS. (1) Wear is evenly distributed over the whole side of the belt—LONGER LIFE! (2) Uniform side-width grip on the pulley—FULL DELIVERY OF POWER!

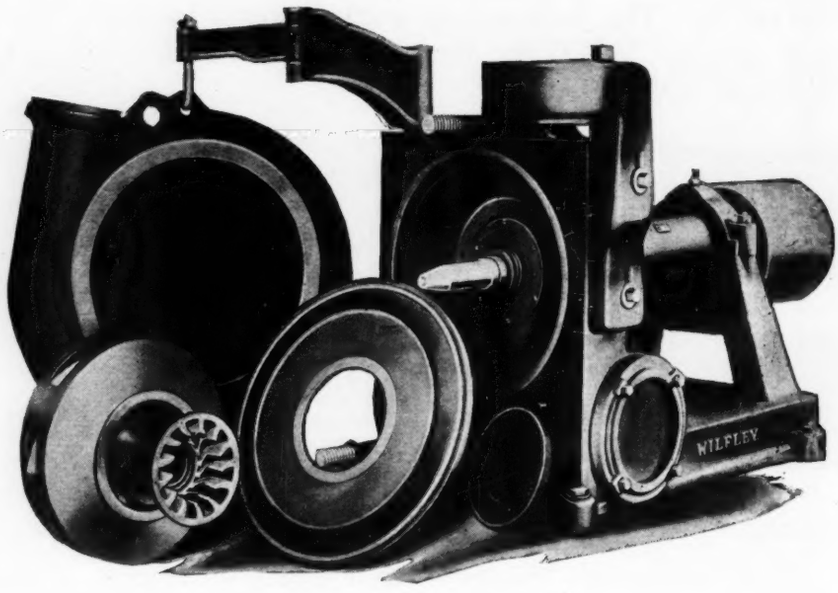
GATES VULCO ROPES

Manufactured by the Gates Rubber Co., Denver, Colo.

The World's Largest Manufacturer of V-Belts

10 to 15 Minutes

. . . for Changing Pumping Parts



WITH THE Wilfley Sand Pump, the pump man spends only ten to fifteen minutes changing the pumping parts.

The design is such that relatively only a few nuts need to be loosened or taken off, a couple of bolts withdrawn and the pump is opened up for renewals.

Saving time in making parts renewals is one of the several features of the Wilfley Pump that means low-cost pumping.

CENTRIFUGAL WILFLEY PUMPS

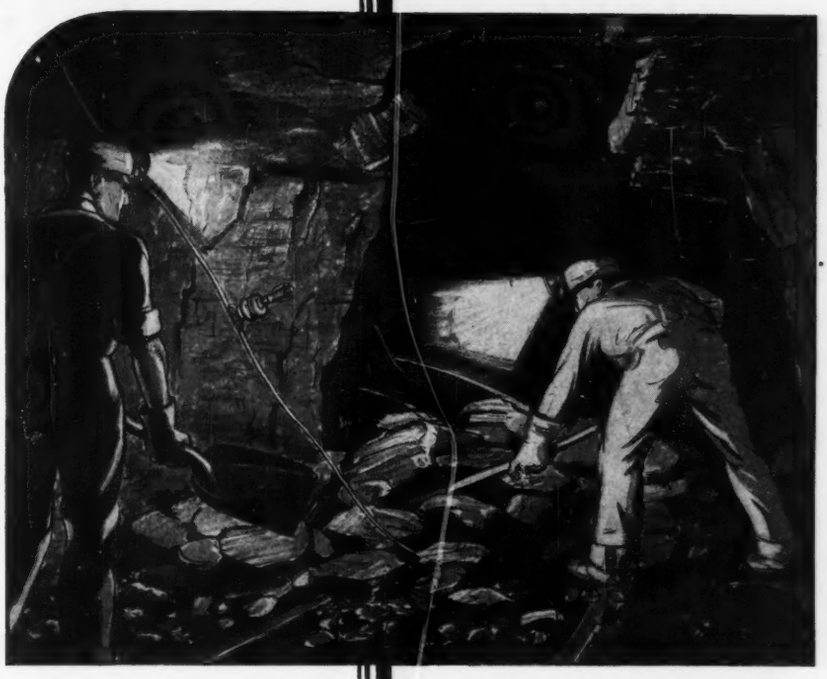
A. R. WILFLEY & SONS, Inc.

P. O. Box 2330 DENVER, COLO., U. S. A.

WILFLEY Centrifugal SAND PUMP

PATENTED

PULLS, HITS, AND STRIKES— *EVERYDAY HAPPENINGS*



THE DOWNPULL of roof-falls as they strike the trolley, the side strains and smacks of flying trolley poles as they hit the hanger, are everyday loads placed on expansion bolts—and everyday excuses for the tired, ordinary bolts to crack; to let loose their grips and delay haulage. Given strong, non-tiring, non-brittle expansion bolts, mine electricians can keep the haulageway free from such troublesome delays to continuous, profitable haulage.

♦ O-B Expansion Bolts offer much in the way of freedom from such aggravating time and production losses. These bolts are made of Flecto non-brittle malleable iron. Their shell will bend double without breaking. They are thick, heavy and strong. Let the downward thrust of roof-falls, let the everyday pulls, the hits, the strikes come upon an O-B Expansion Bolt; it will take the punishment without growing tired and cracking. Ohio Brass Company, Mansfield, Ohio; Canadian Ohio Brass Co., Limited, Niagara Falls, Canada.

1376M

KEEPING DOLLARS *from* WAITING ON DIMES

O-B EXPANSION BOLT

Made in 4 and 6-inch shells. Ordering information is to be found on page 496 of the O-B Catalog No. 20.

Ohio Brass Co.

NEW YORK PITTSBURGH CHICAGO CLEVELAND ST. LOUIS ATLANTA DALLAS
PHILADELPHIA BOSTON LOS ANGELES SAN FRANCISCO SEATTLE

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES

Solving

A few examples:

Following the recommendations of our engineers, the power plant of one large company reports: "In 18 months two hundred hours of lost time saved . . . Turbine oil consumption reduced from 2,115 gallons to 741 gallons, a saving of 1,374 gallons."

Another mine after a six month's trial of Standard Oil Company (Indiana) lubrication service and lubricants, effected a saving of 30% in lubrication costs.

Having considerable difficulty with mine cars due to dust and widely variable weather conditions, another mine operator consulted with one of our engineers, followed his recommendations and since has had excellent lubrication service.

Another mine, following the recommendations of our lubrication engineers, reduced lubrication troubles with mine cars and hoisting equipment and at the same time lowered lubrication costs 22%.

COMPLETE LUBRICATION SERVICE

the lubrication problems of midwestern mines. . .

THE necessity for reducing operating costs in mining to meet present conditions has brought to the attention of many executives much startling information concerning lubrication.

Many supposedly efficient lubrication practices have actually proved to be costly and ineffective. Many lubricants used have been found to be hopelessly inadequate for the work they were doing.

Many of the mines throughout the Middle West have turned to Standard Oil Company (Indiana) lubricants and lubrication service to solve their lubrication problems. Many have made substantial savings in lubrication costs — in one or two cases savings as high as 40%. In some instances economies were made which affected entire mines.

The Standard Oil Company (Indiana) makes it easy for you to secure effective, economical lubrication. In the thirteen mid-western and mountain states in which the company operates, it has thirty-one branch offices. Expert lubrication engineers are maintained at various offices and are at your service to help you determine the correct lubricants and lubrication methods for your needs.

That our engineers may have the best facilities to work with, we have developed a complete line of lubricants for industrial needs and maintain extensive research and testing laboratories.

Look to your lubrication methods—call in one of our engineers—he may be able to point out hidden losses which can be remedied with considerable saving to you. Such service places you under no obligation.

STANDARD OIL COMPANY
(INDIANA)

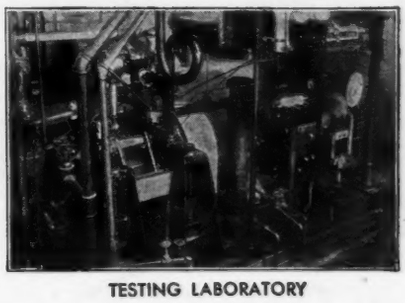
1406

910 South Michigan Avenue Chicago, Illinois

Billings	Denver	Evansville	Huron	La Crosse	Milwaukee	Saginaw	St. Joseph
Cheyenne	Des Moines	Fargo	Indianapolis	Mankato	Minot	Sioux City	St. Louis
Davenport	Detroit	Grand Rapids	Joliet	Mason City	Peoria	South Bend	Wichita
Decatur	Duluth	Green Bay	Kansas City	Minneapolis	Quincy		

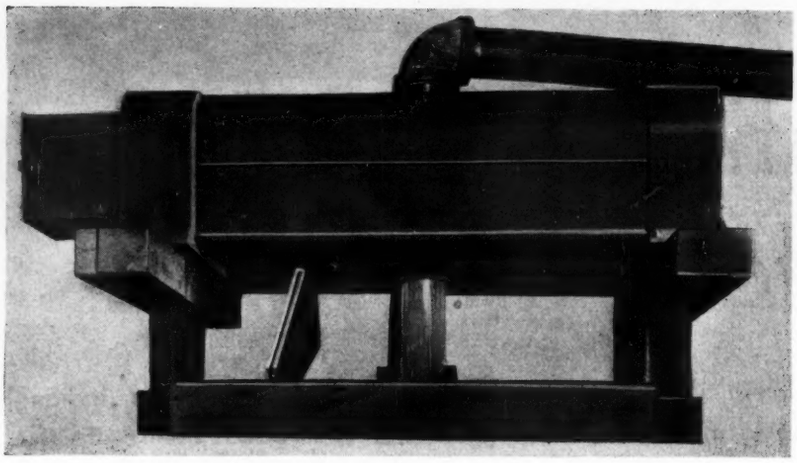
LUBRICATION STUDY

RESEARCH LABORATORY



TESTING LABORATORY

FOR MID-WESTERN MINES

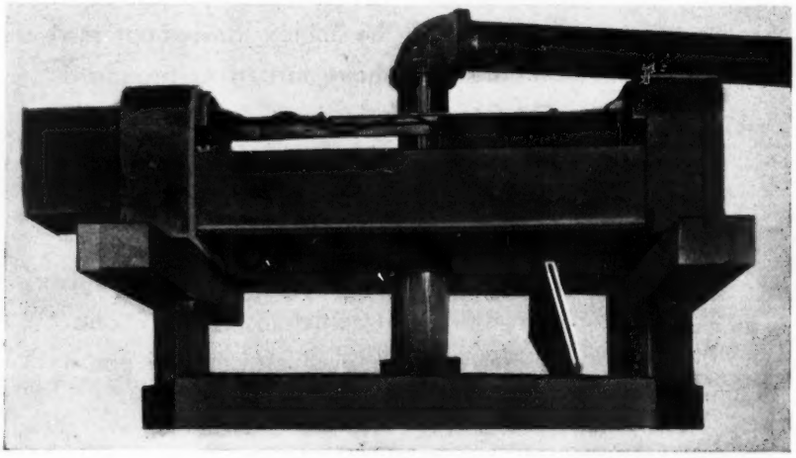


GECO Electric Sampler with cover in place.

GECO ELECTRIC SAMPLER

(Patents applied for)

for taking accurate automatic wet or dry samples in ore treatment and industrial plants



GECO Electric Sampler with cover removed.

THE cutter carriage unit comprising speed reducer, motor and reversing switch, is entirely enclosed within a dust-proof cast-iron case, protecting them from moisture, dirt and grit. This enclosed unit is again covered by the sampler case, made up of cast iron heads and steel plate body.

The specially designed timing mechanism is driven by a Telechron motor, starting the cutter carriage at predetermined time intervals.

We have specialized on automatic sampling equipment for twenty-five years, have developed many samplers, and can conscientiously recommend the GECO Electric Sampler as the most accurate, simplest and reliable sampler of any of them.

We should appreciate the opportunity to mail you a descriptive bulletin, discuss your sampling problems with you and furnish you with specifications and quotations.

Consulting
Research
Ore Testing
Designing
Construction
Improvement in plant operation
Flotation Plant Equipment
Laboratory Equipment

The General Engineering Company

CONSULTING METALLURGICAL ENGINEERS

159 Pierpont Street, Salt Lake City, Utah
350 Bay Street, Toronto, Canada (R. M. P. Hamilton, Rep.)
Adelaide House, London, England
50 Broad Street, New York, N. Y.

$90 BUYS

the finest 20 cu. ft. all steel mine car you ever saw!

Here's astonishing value—an arc-welded all-steel mine car of 20 cu.ft. capacity, with roller bearing 12″ steel wheels and roller turntable for only $90. Look into it!

READ THESE DETAILS:—

Bodies arc-welded—not a rivet or bolt to loosen up—great strength and lightness; material—sides and door ⅛ in. sheet steel, bottoms ¼ in. plate, bands ⅜ in. x 1½ in.

Unbreakable steel wheels with roller bearings in the wheels—automobile practice, each wheel rotates independently—easy running on curves—labyrinth Hub Housings, perfect protection from dirt and water.

Roller turntable—fully housed rollers require no lubrication.

All castings of steel.

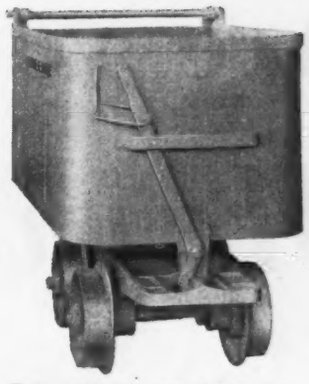
Cars made for 18 in. track gauge only.

Prices f.o.b. Berkeley, Calif.

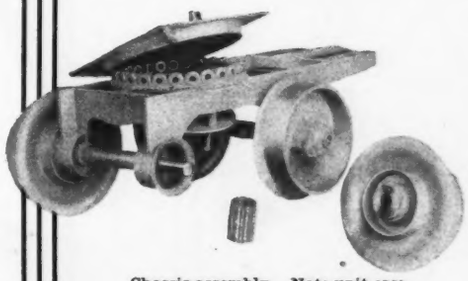
20 cu.ft. cap., 12 in. wheels, weight 740 lbs..... $90

16 cu.ft. cap., 10 in. wheels, weight 660 lbs..... 85

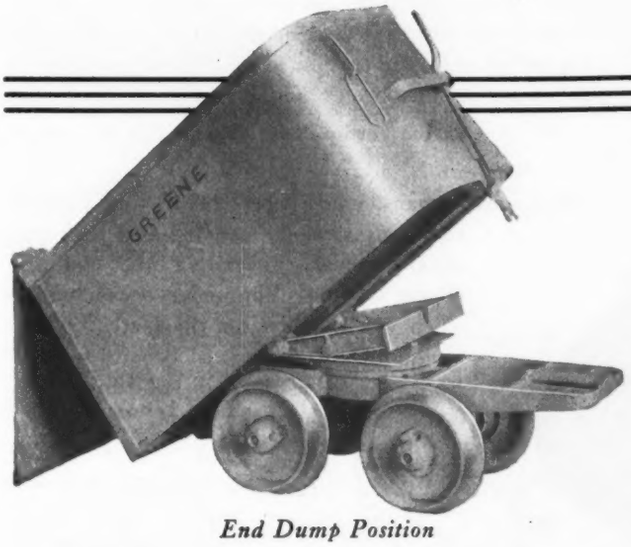
Brakes acting on all four wheels $12 per car extra.



Rear view showing latch and standing platform. False bottoms of ¼-in. plate—$6.25 for 16 cu.ft. car, and $7.60 for 20 cu.ft. car extra.



Chassis assembly. Note unit cast steel frame with shaft housings attached by arc-welding. Perfect and permanent wheel alignment is thus assured.



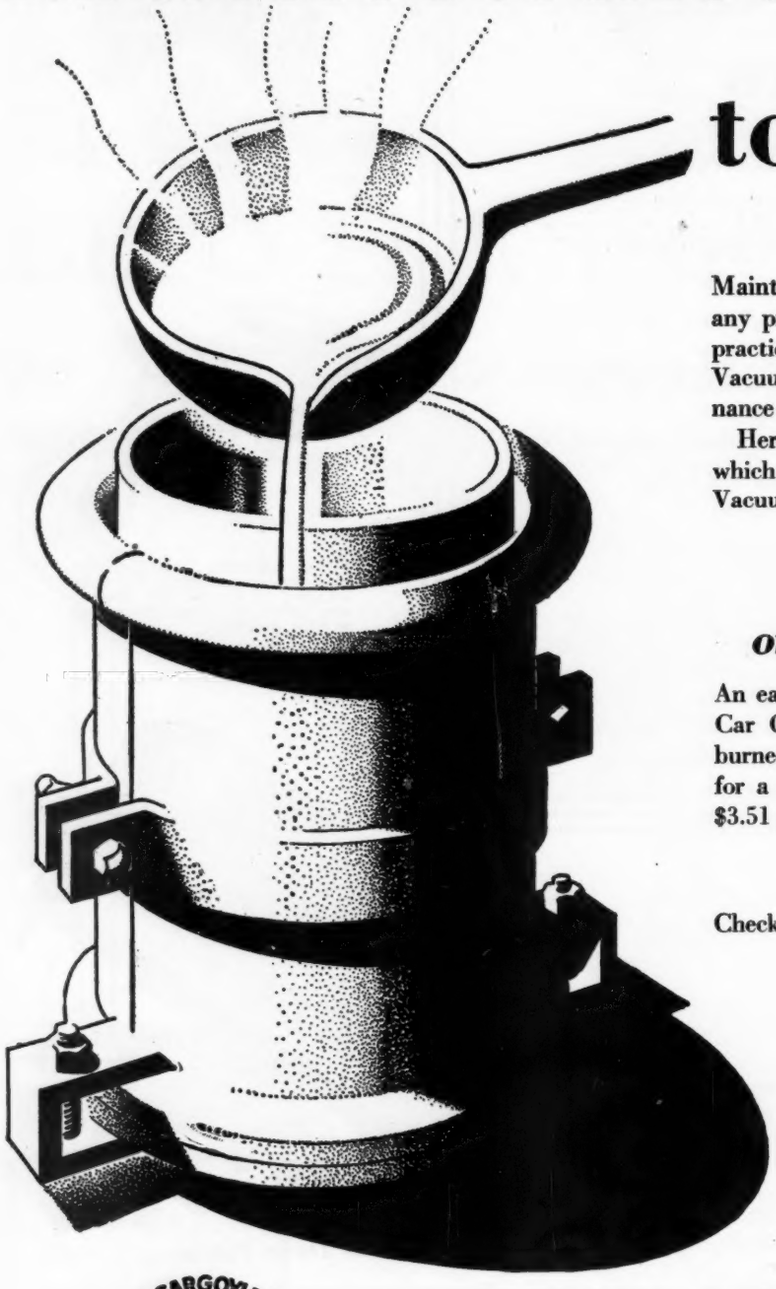
End Dump Position

Side Dump Position

GREENE TYPE A MINE CAR

GREENE MFG. CO., 1821 5TH ST., BERKELEY, CALIF.

Are your *Maintenance Costs* too *High?*



Maintenance costs are always too high, when there is any practical way of reducing them. And there *is* a practical way. In plants throughout all industries, Vacuum Lubricants and service have reduced maintenance costs.

Here is one of several thousand performance stories which shows how maintenance costs were cut by Vacuum lubrication methods.

Nearly $3000 saved on mine car maintenance

An eastern mine replaced black oil with Voco Mine Car Grease Medium. A saving of $9 per day on burned-out boxes resulted—a saving of almost $3,000 for a full year's operation. In addition a saving of $3.51 per day has been made in cost of the lubricant.

(From Vacuum Oil Company File No. 11168)

Check *your* maintenance costs with the Vacuum representative—he can tell you with reasonable accuracy whether *you* can also expect savings. You incur no obligation when you ask him for the facts. Address Vacuum Oil Company, 61 Broadway, New York. Branches and distributing warehouses throughout the world.

GARGOYLE

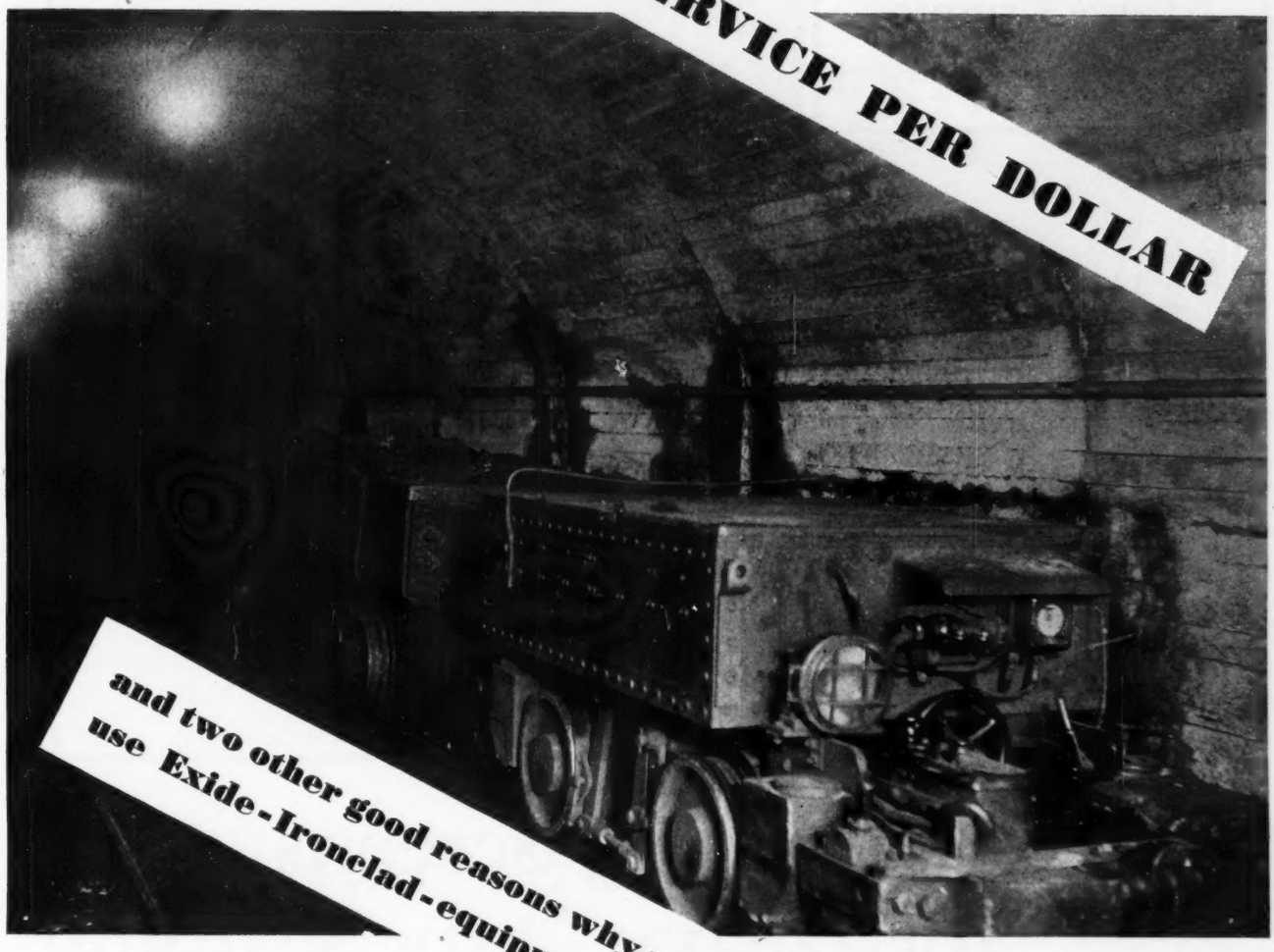
Lubricating Oils

Bearings and Their Lubrication, Air Compressor Lubrication, Stationary Steam Engines, Machine Shop Lubrication, Gear Lubrication, Machine Bulletin—Conveyors, Machine Bulletin—Crushers.

We shall be glad to send one or all of the above technical treatises on lubrication, to any executive or engineer, if requested on your company letterhead.

VACUUM OIL COMPANY

MORE SERVICE PER DOLLAR



and two other good reasons why you should use Exide-Ironclad-equipped locomotives

Extra-heavy loads or steep, slippery grades do not faze Exide-Ironclad-equipped locomotives. Haulage delays are reduced . . . money saved.

1. Power aplenty for any job

2. Absolute safety assured

LONG, active life . . . greatest service for each dollar invested—that's what you get with Exide-Ironclads in mine haulage service. These batteries have tremendous reserve power . . . maintain high electrical efficiency. They reduce mine hazards . . . eliminate trolley and voltage risks.

In construction, an Exide-Ironclad is absolutely different from any other battery made. The positive plate is composed of finely slotted rubber tubes. These tubes retain the active material, yet allow free access of the electrolyte.

This construction is the reason for the trouble-free, dependable, dollar-saving performance of Exide-Ironclad Batteries in mine service. Learn about the economy of Exides. Write for booklet, "Facts for Consideration in Selecting a Storage Battery."

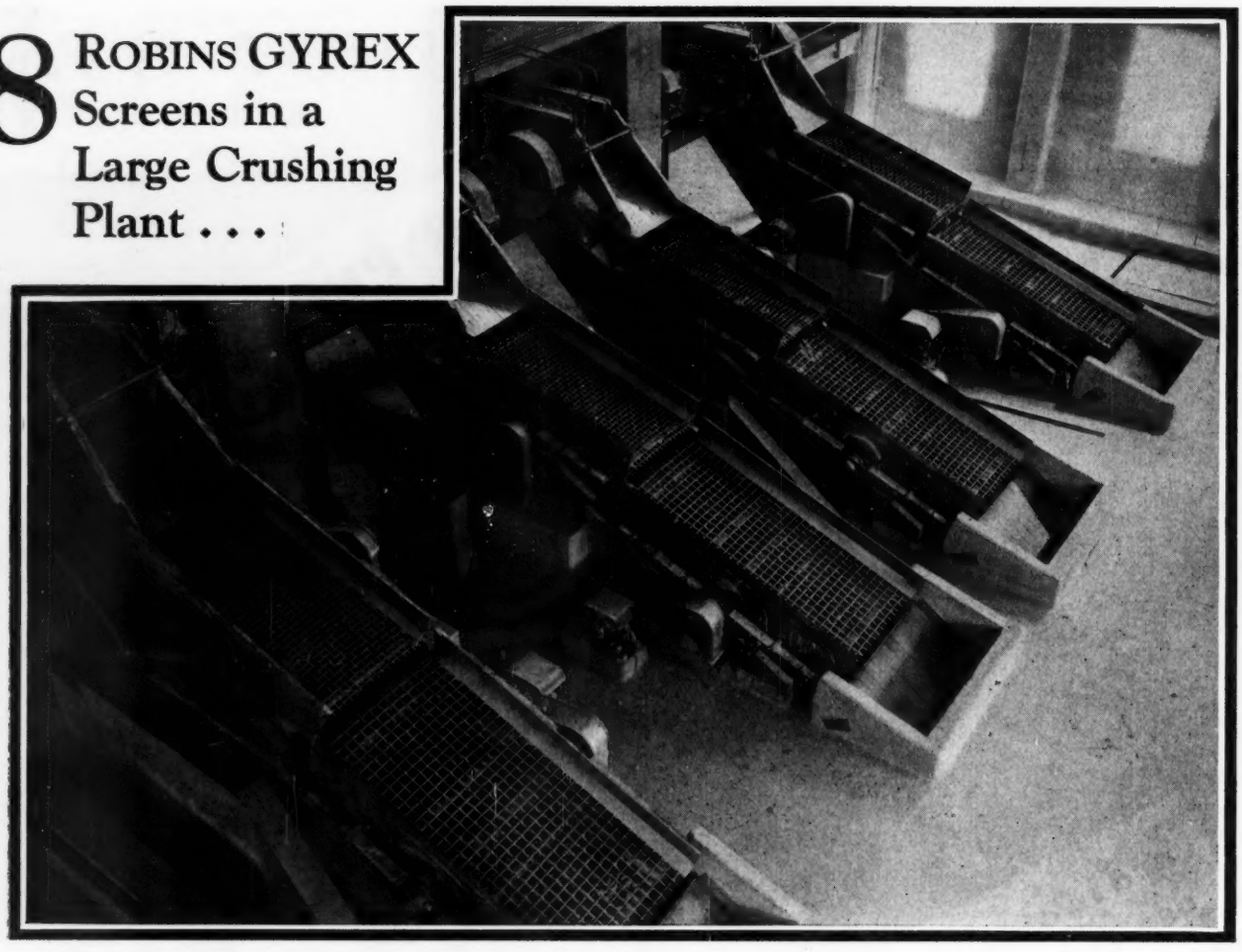
Exide
IRONCLAD
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE

Exide Batteries of Canada, Limited, Toronto

8 ROBINS GYREX Screens in a Large Crushing Plant . . .



Sturdy, Vibrating Screens for Heavy Duty Scalping

These eight GYREX Screens replaced four large trommels.

The flowsheet calls for the closed circuit handling of 1600 t.p.h. of "run of crusher" rock over the four tandem sets. With a ½" stroke and a 625 r.p.m. speed, the efficiency is 96% or better.

The story of this GYREX purchase is the story of Robins Screen success in general. The purchaser first tried out the GYREX against other makes—and bought twenty units for intermediate screening. Then, after operating these twenty for nearly a year and checking results and costs, ordered the eight large units shown for scalping work. And in addition, this company uses sixteen Robins VIBREX Screens for fine screening.

Robins Screens offer the best line from which to select the screens you need because they provide the most complete range of action, speed and stroke.

ROBINS CONVEYING BELT CO.

NEW YORK CHICAGO

Boston Philadelphia Pittsburgh

London, England Johannesburg, South Africa

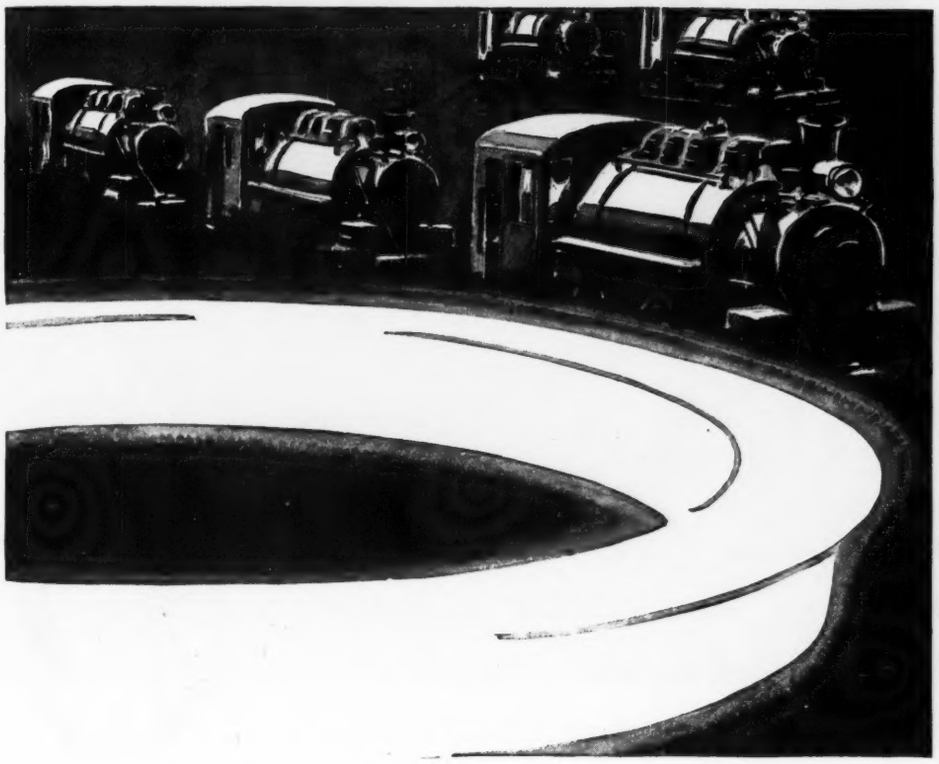
Representatives:

Birmingham	*C. B. Davis Engineering Co.*
Picher, Okla.	*Ore Reclamation Co.*
El Paso (For Mexico)	*Ammex Equipment Co.*
New Orleans	*A. M. Lockett & Co., Ltd.*
San Francisco	*Joshua Hendy Iron Works*
Salt Lake City	*The National Equipment Co.*
Seattle	*B. F. Esterbrooks Co.*

MATERIAL HANDLING **ROBINS** EQUIPMENT

Conveying and Elevating Equipment
Scalping and Screening Equipment
Ore Bedding Systems

MIDVALE



builds lasting strength into locomotive tires . . . insuring more mileage and longer wear

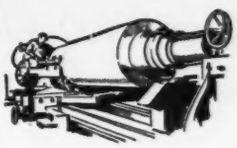
WHEN the brakes shut down, on a down grade, with a string of loaded cars behind—there is *tearing wear* on a locomotive tire. Extra months, sometimes extra years, of life mean saving annoying and costly delays. A prominent official in one of the leading coal companies said, "Our locomotive tires gave us constant trouble until we used Midvale tires. Now, for several years, we have almost forgotten that tires do wear out."

Midvale tires are made of high carbon steel, actually tool steel. From the ingot clear through to the finished tires they are repeatedly tested. The same toughness and strength that has won their place on the world's fastest train makes them dependable servants in the daily grind of mine work.

And remember that the Midvale Company is ready to help on any other steel problem you meet. Write or phone the nearest office. Philadelphia, New York, Washington, Pittsburgh, Cleveland, Chicago or San Francisco.

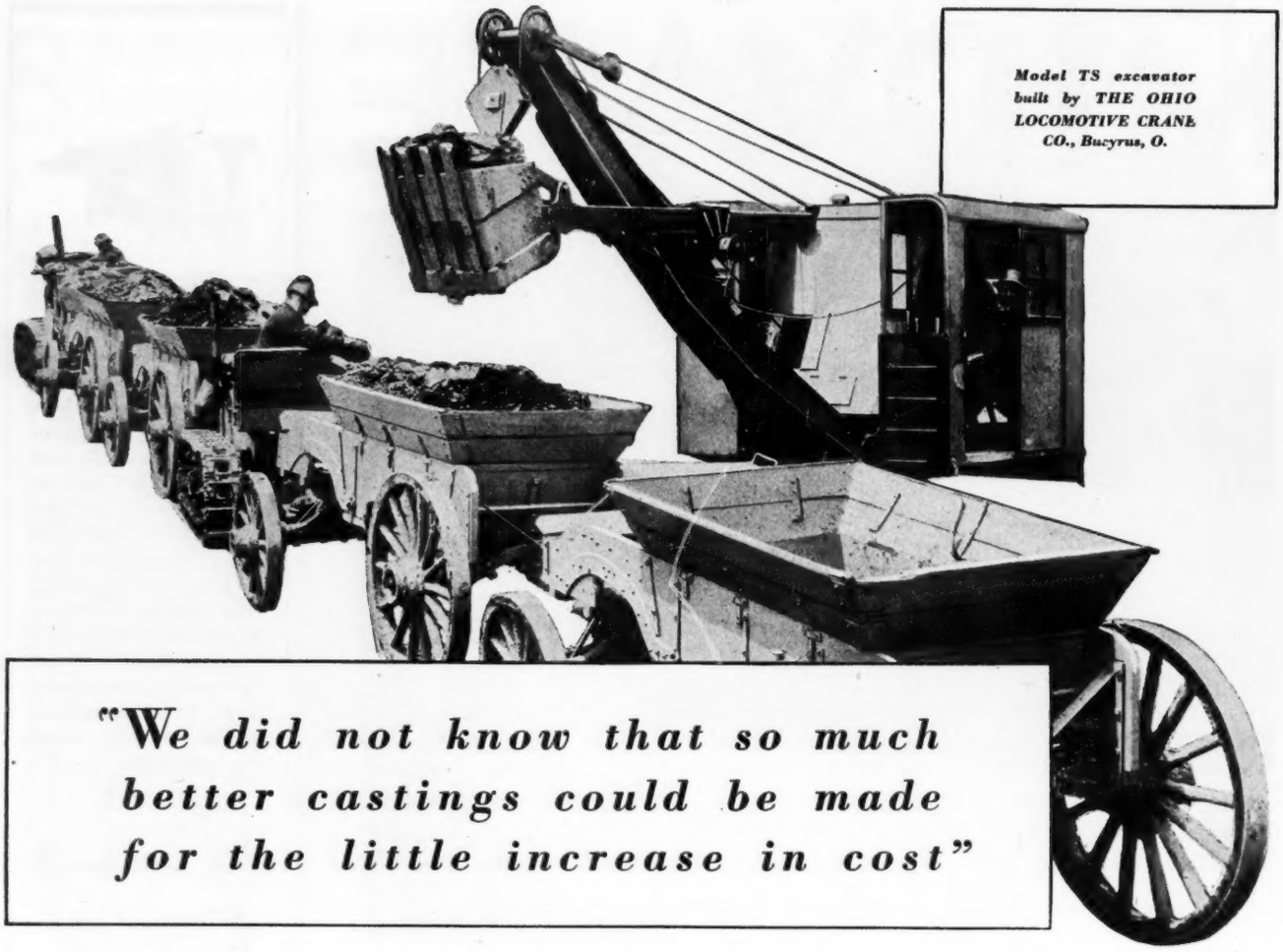
DRILL STEEL

On surface work, or underground, the harder the rock the more truly is the best steel the most economical. Carefully and minutely checked in every stage from the ingot to the final bar. Holes clean and true to size, and centrally located in the bar. Midvale Drill Steel's extreme hardness and splendid structure make it stand up under the toughest working conditions.



TOOL STEEL

Midvale does not follow the "tonnage" method of tool steel production. Midvale charges with cold metal. Lets the ingots cool, to permit inspection for faults. Carefully chips out any cracks. Reheats ingots and reduces to billet size. Sand-blasts the scale. Again inspects and chips when necessary. Reheats and rolls to finished size. This is the only method by which tool steel of Midvale quality can be produced.



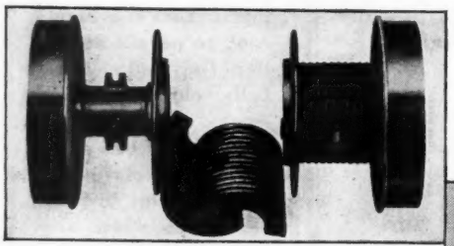
Model TS excavator built by THE OHIO LOCOMOTIVE CRANE CO., Bucyrus, O.

"We did not know that so much better castings could be made for the little increase in cost"

● **A vital part of every power shovel or excavator is the hoist drum. While the machine is operating, the drum is in constant use... making quick starts and sudden stops... subjected to the violent shocks of varying loads.**

Because it provides improved strength, toughness and wear-resistance, Nickel Cast Iron is used for drums in Model TS excavators built by The Ohio Locomotive Crane Co., who for more than a quarter of a century have been manufacturers of high-grade excavating equipment. "We also make all our hydraulic steering mechanism, including cylinders, and in fact any cast iron parts used on the Model TS excavator, of Nickel Cast Iron, as it has proven superior to the regular cast iron", this company states. "We did not know that so much better castings could be made for the little increase in cost."

Leading manufacturers have found that Nickel Cast Iron parts mean economical operation in material handling equipment... it "performs better longer".



Nickel Cast Iron hoist drum and associated parts used in Model TS excavator produced by Marion Foundry Co., Marion, O.

THE INTERNATIONAL NICKEL COMPANY, INC.

Miners, refiners and rollers of Nickel... Sole producers of Monel Metal

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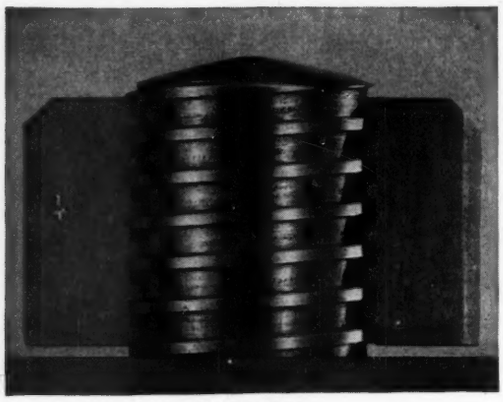
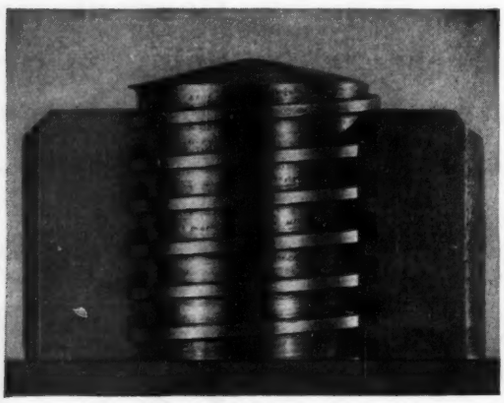
ANNOUNCING that C. F. & I. has been licensed to manufacture and sell DARDELET NUTS AND BOLTS



UNLOCKED

The Dardelet Thread locks by reason of its mathematically designed profile. There is a taper of 6° at the bottom of the bolt thread groove and a corresponding taper on the crest of the nut thread. These are the locking surfaces. The nut runs freely along the bolt thread until it comes in contact with the work. Then a partial turn of the wrench causes the nut to rotate without advancing on the bolt. This wedges the tapered thread faces powerfully together. The nut comes off just as easily as it goes on.



LOCKED

THE DARDELET self-locking screw thread can now be obtained on bolts and nuts manufactured by The Colorado Fuel & Iron Company.

Wherever you have difficulty due to nuts working loose, use COLORADO bolts and nuts with Dardelet Thread. You will absolutely do away with loose nuts and at the same time reduce assembly and maintenance costs.

The Dardelet self-locking screw thread has the following advantages:

1 Nuts remain absolutely tight under all service conditions.

2 Assembly time reduced, due to free running nut.

3 Auxiliary locking devices are unnecessary, therefore shorter bolt may be specified.

4 Dardelet threaded bolts are stronger in tension and against shock than U. S. Standard Threaded bolts, because of greater root area and form of thread.

5 The Dardelet Thread is uninjured by the locking action; therefore both bolt and nut may be reclaimed for future use.

Write us for further information.

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for the Mining Industry

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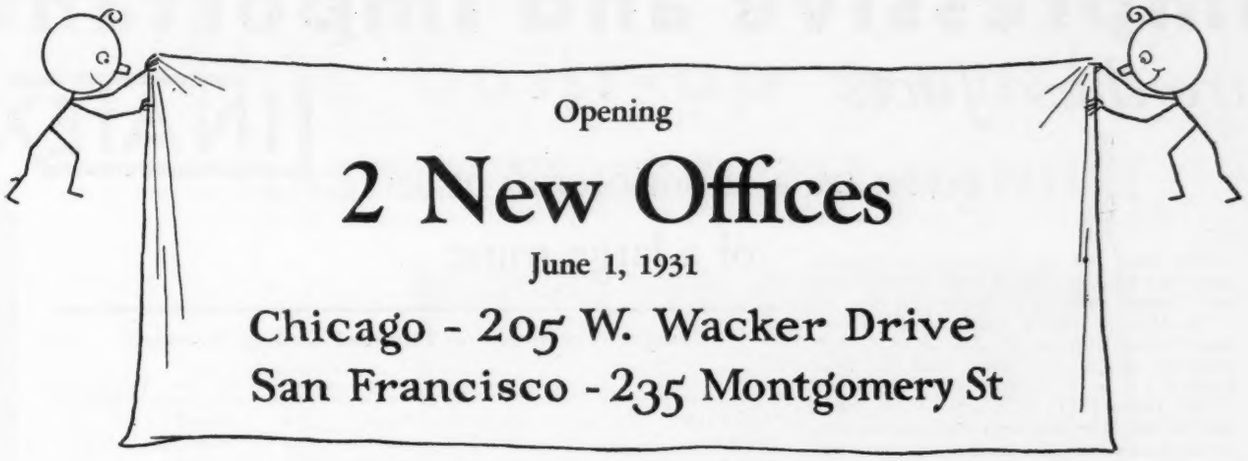


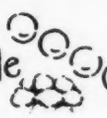
Opening

2 New Offices

June 1, 1931

Chicago - 205 W. Wacker Drive
San Francisco - 235 Montgomery St

To better serve our customers using our very successful mining, industrial and sanitation equipment, we have opened two new offices.

Conical Ball Pebble  Rod & Tube Mills

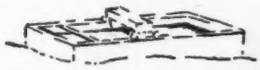
Volumetric and Weighing Feeders

Rotary Tubular Conveyors

Ruggles - Coles Dryers

Thickeners Clarifiers

Keystone Lime Kilns

 Sanitation Equipment

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are these facts

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given by a superintendent of a large mine

"We think that the following information regarding the behavior of your rubber material 'Linatex' will be of interest to you.

"On May 12, 1930 a 6-inch launder carrying oversize from an elevator to rolls, mesh from 5/8" to 1/4", was lined with 3/8" thick Linatex.

"On January 19, 1931 after 4,180 hours' service this liner was examined and showed no signs of wear. To confirm this statement we are mailing you a sample 1" wide which we cut off this piece of lining when we took it out for examination on January 19, 1931.

"The launder in question handles 150 tons of material per twenty-four hours and previously 1/4" steel plate gave a life of only 264 hours.

"You will find enclosed a tabulated sheet showing comparative test on various launder linings."

Comparative Costs on Launder Lining Materials

Material	Size	Weight	Cost per Lb.	Average Life in Operating Hours	Cost per Operating Hour	Weight When Discarded
Steel Plate	1/4"x6"x65"	14.025 lb.	$0.04	264	$0.00212	.....
Rubber A	1/4"x6"x65"	3.625 lb.	0.925	1311	0.00256	1 1/2 lb.
Rubber B	1/4"x6"x65"	4.375 lb.	1.115	1099	0.00443	1 3/4 lb.
Linatex	3/8"x6"x65"	4.937 lb.	1.385	4180	0.00163	.....

hours to Jan. 20, 1931 — to date Jan. 21, 1931, *Note below.*

NOTE: This cost per hour is incomplete in as much as the Linatex lining showed no signs of wear and the other liners were completely worn out.

Write for Information and Samples

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We invite you to consult us and avail yourself of our experimental furnace and laboratory, and our experience in solving your particular problem. Because of recent expansion, we are now, more so than ever before, in a position to render you service and satisfaction.

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MERCO

This built-up mantle
OUTLASTED THE ORIGINAL MANTLE!

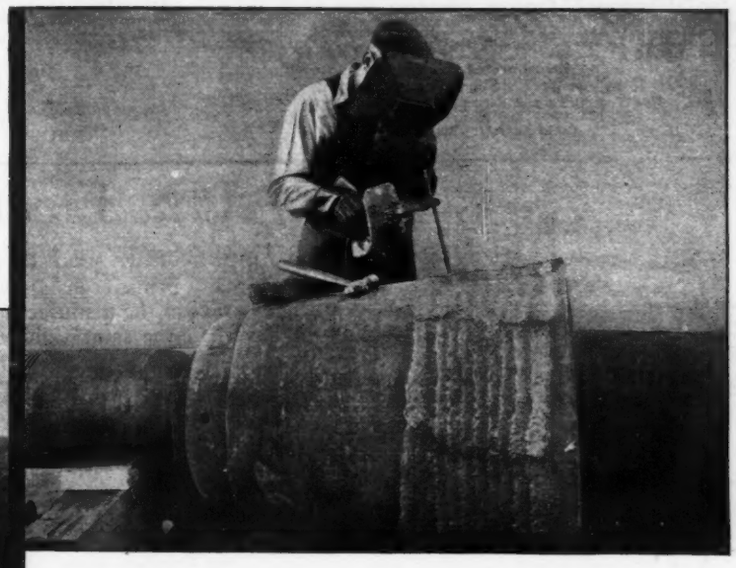
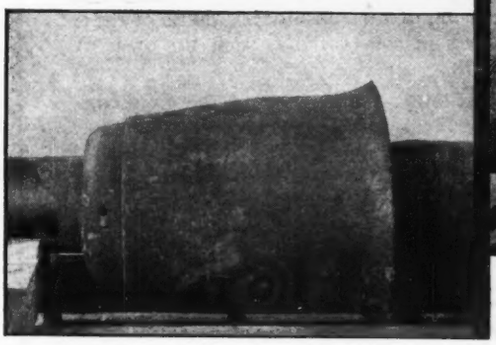


Photo shows worn out mantle being built-up with TIMANG *(air-toughening) welding rod. Below—worn out mantle before welding.*



...built-up with TIMANG (AIR-TOUGHENING) Welding Rod

TIMANG (air-toughening) Welding Rod has brought mantle costs to a new low level in this large crushed stone plant. Read what the operator of this plant said in a recent letter.

"The built-up mantle has been in service for a full season and it is still good for additional service. The original mantle was used one year when we discarded it as worn out."

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Welds made with TIMANG have the same hardness, the same resistance to wear, as 12% manganese steel. TIMANG is an exclusive product of Taylor-Wharton Iron & Steel Co.

"TIMANG" Trade Mark is registered in United States and foreign countries. "TIMANG" Steel is protected by U. S. Patent 1,782,202 and foreign patents. Other patents pending.

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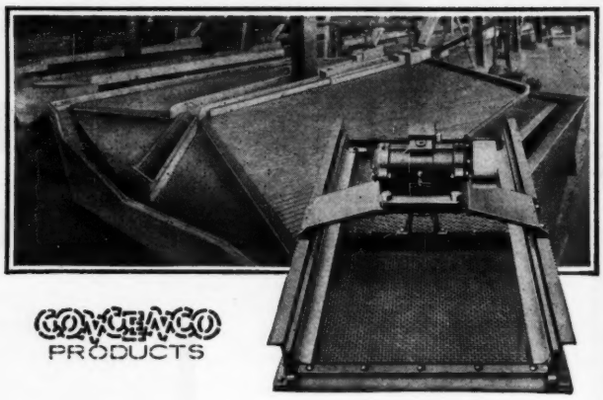
The Leahy No-Blind Vibrating Screen is also shown. It has the "differential" form of vibration that gives large capacity in sizing.



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Gentlemen: Kindly send us detailed, illustrated literature on your R-120 Dustpruf Respirator.

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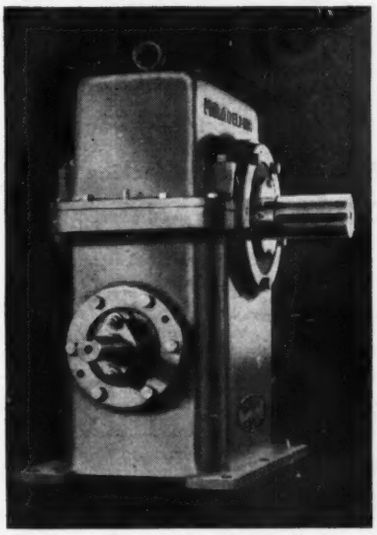

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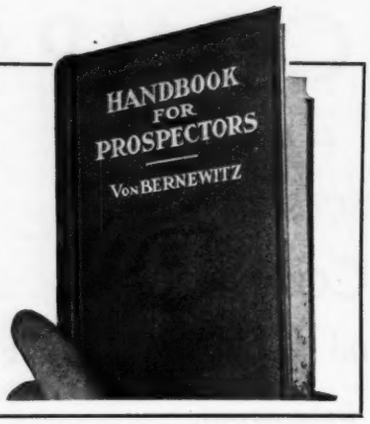

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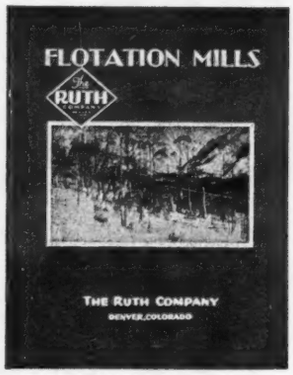

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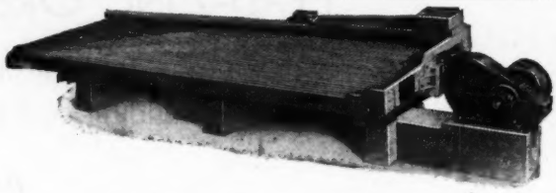

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RIB-CONE

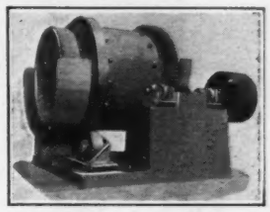
Change-Head MILLS

DO GIVE

More Capacity

WITH

LESS POWER



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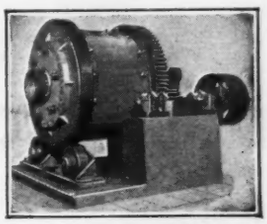
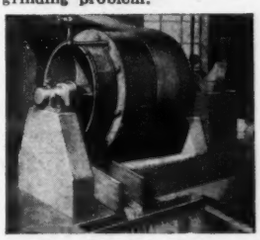
And steel construction in place of cast iron saves useless weight. This modern mill shows a saving in every power bill.

Rib-Cone Change-Head Mills are adaptable to every ore and every grinding problem.



As a screenless mill for outside classification



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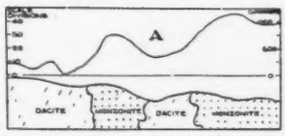
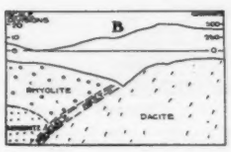
For Rapid Magnetic Exploration

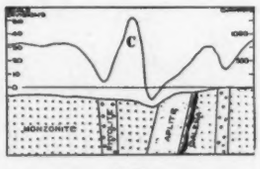
Sensitive—Simple—Swift—Strong



Magnetic profiles and the geologic sections from the American Boy Mine, near Patagonia, Ariz.



A. Showing the location of intrusive contacts. (Dacite in Monzonite.)



B. Showing the location of a buried fault.

C. Showing the location of mineralized acid dikes in Monzonite.

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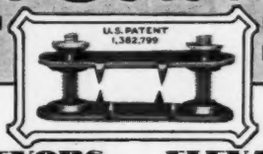

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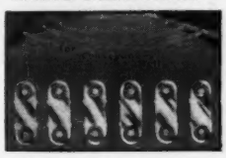

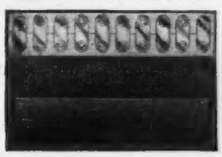

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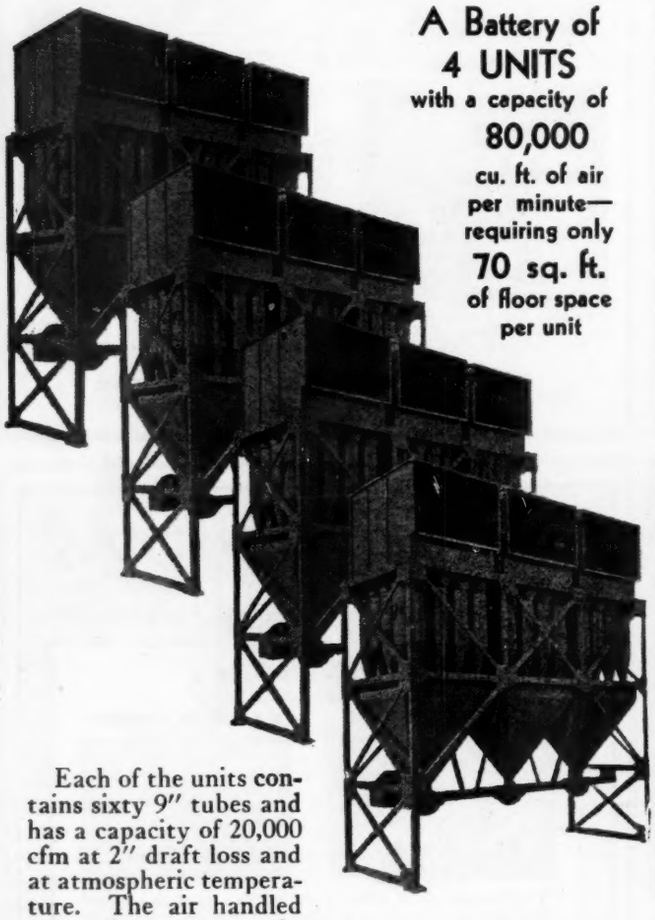

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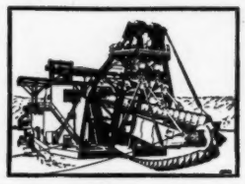

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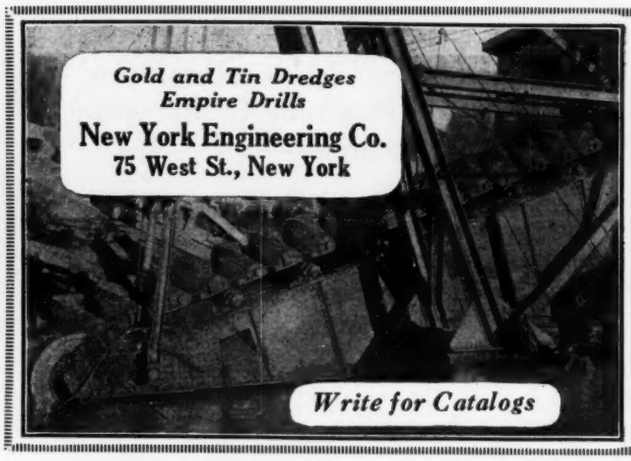

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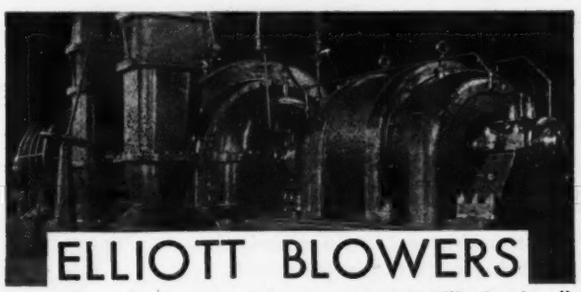

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Drum, 14x14-ft., 10x12-ft., 8x8-ft., 8x6-ft., 6x6-ft. and 6x4-ft.
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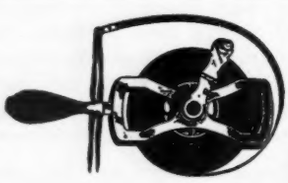

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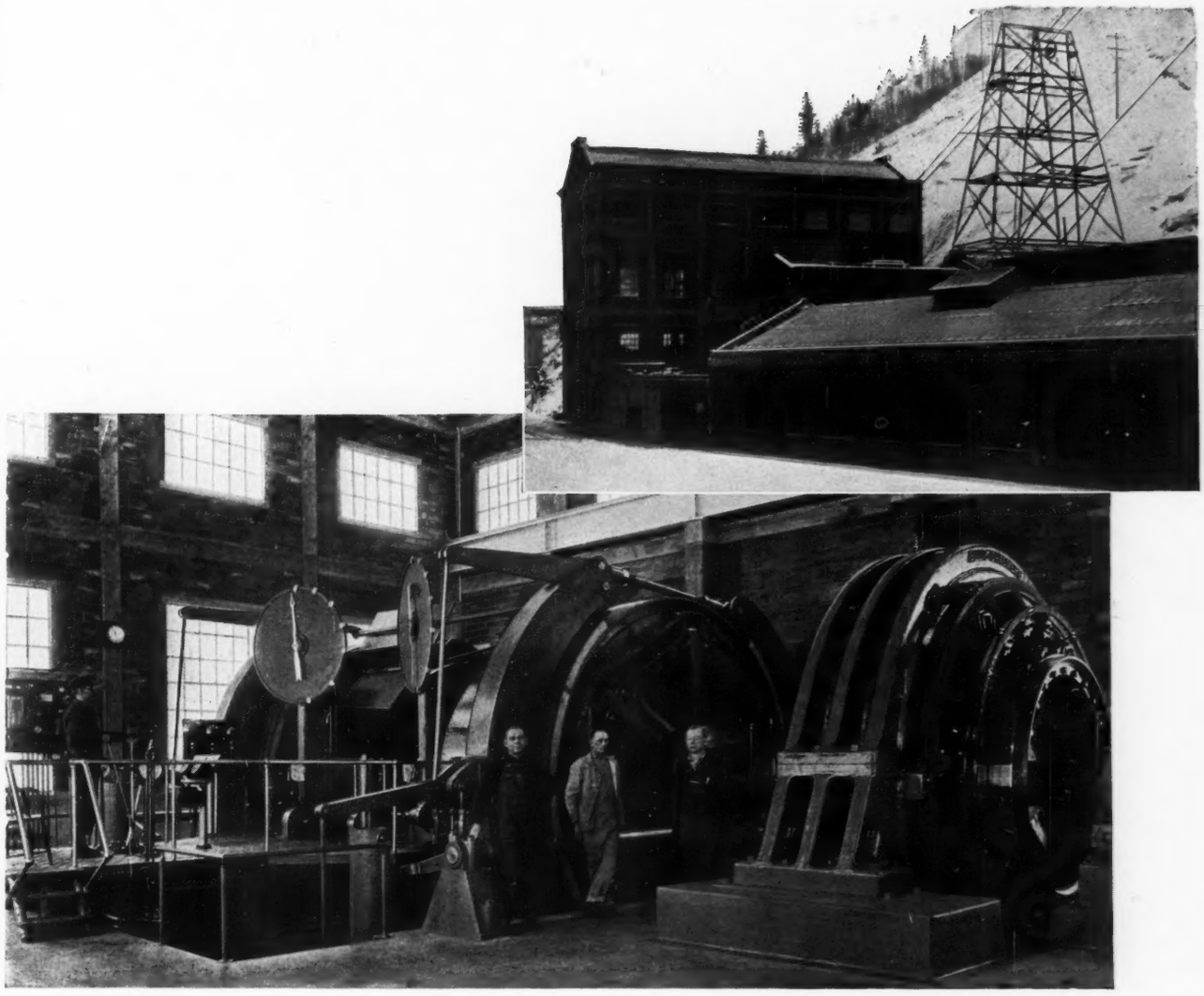

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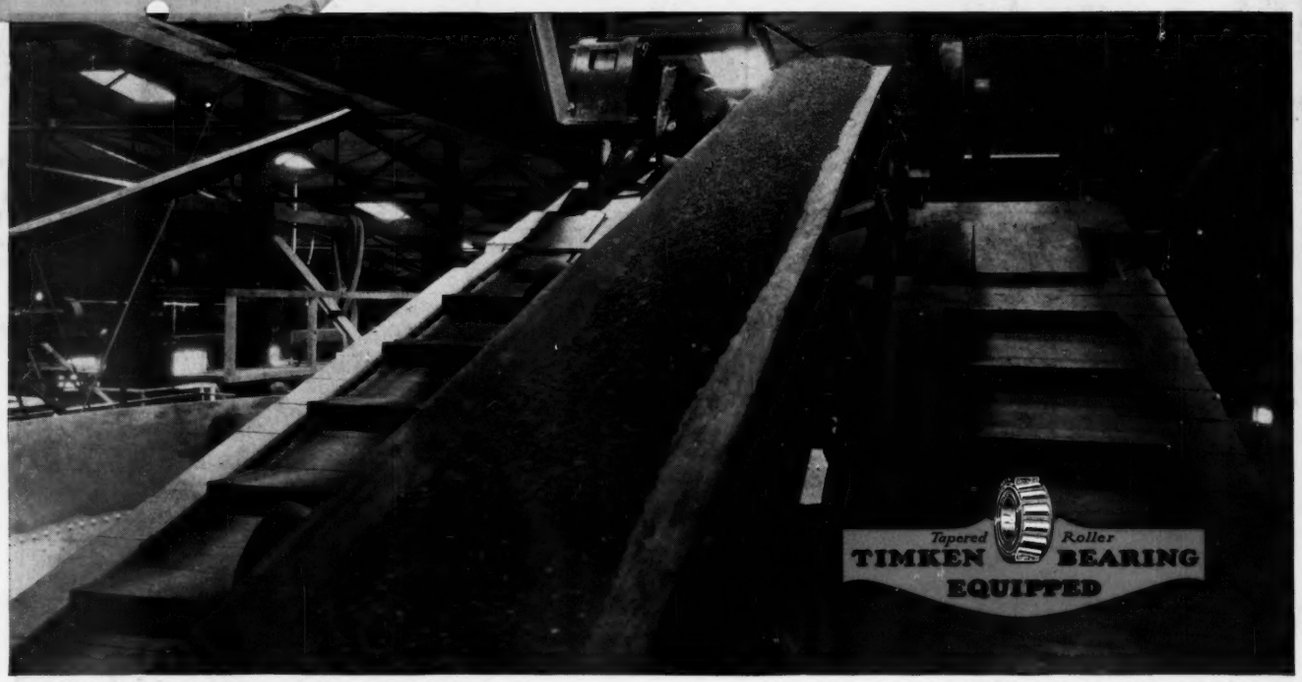

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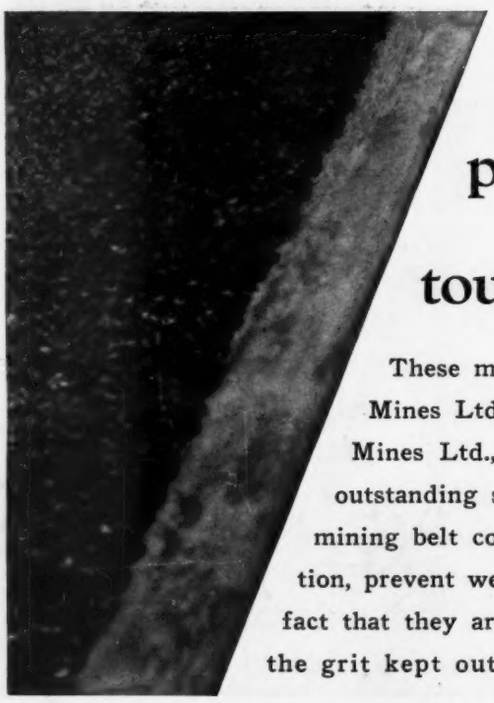

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